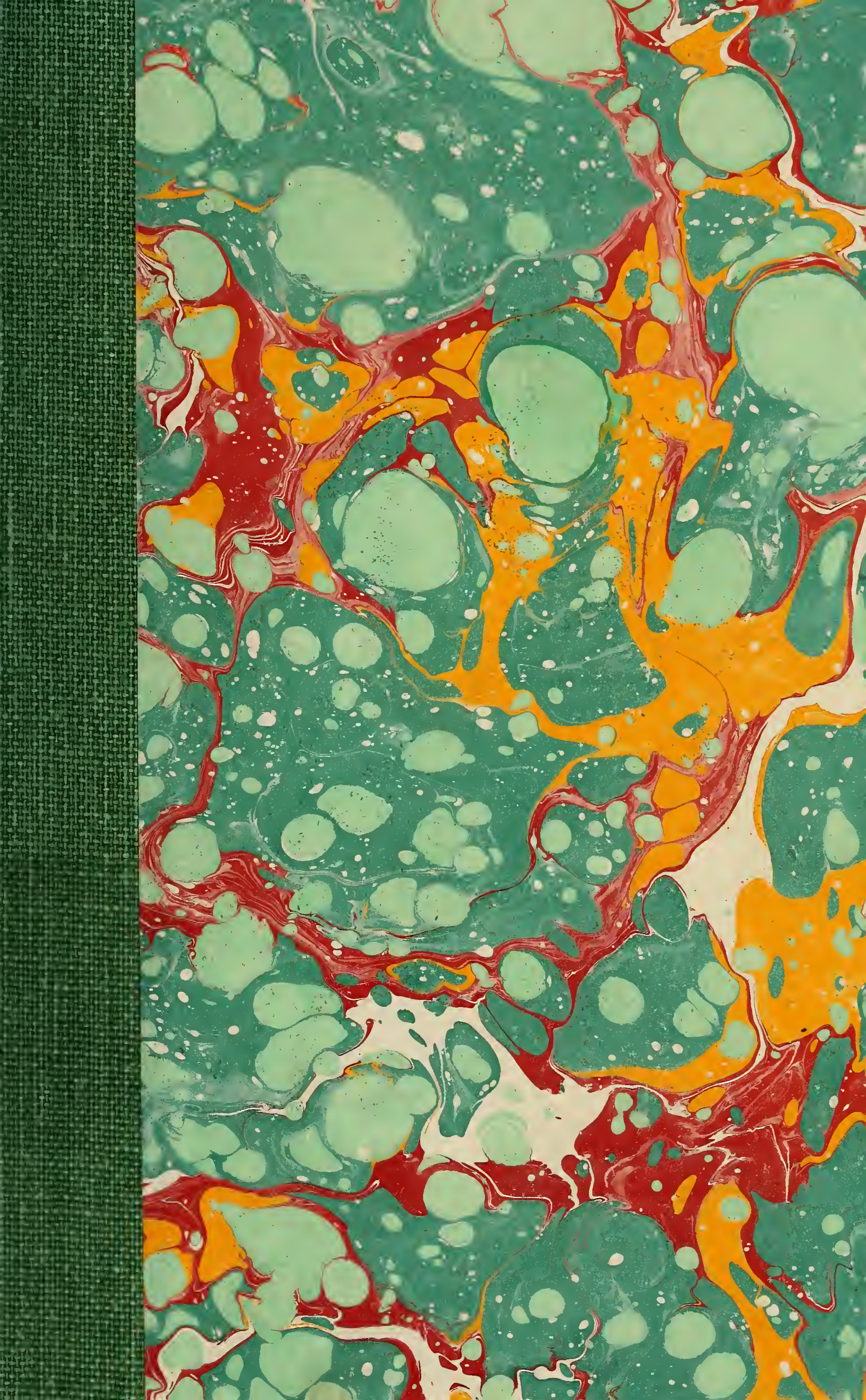

BOSTON MEDICAL LIBRARY
in the Francis A. Countway
Library of Medicine ~ *Boston*

Digitized by the Internet Archive
in 2011 with funding from
Open Knowledge Commons and Harvard Medical School

http://www.archive.org/details/essayonbloodinwh00levi

Henry Leacroft 1/-

AN

ESSAY

ON THE

BLOOD;

IN WHICH,

The Objections to Mr. HUNTER's Opinion concerning the Blood, are examined and removed.

אך בשר בנפשו דמו.

Verum tamen Carnem cum Sanguine ipſius, qui Anima eſt ipſius. *Gen.* ix. 4.

כי נפש הבשר בדם היא.

Nam Anima cujuſque Carnis in Sanguine eſt. *Lev.* xvii. 11.

כי נפש כל בשר דמו בנפשו הוא.

Eſt enim Anima cujuſque Carnis Sanguis ejus pro Anima ejus eſt. *Lev.* xvii. 14.

By G. LEVISON, M. D.

LONDON:
Printed for T. DAVIES, in *Ruſſel-Street, Covent-Garden.*
Dead; ——— Dead!
M. DCC. LXXVI.

BOSTON MEDICAL
AUG 15 1927
LIBRARY

T O

WILLIAM HUNTER, M. D.
Phyſician extraordinary to her
MAJESTY,
Profeſſor of Anatomy to the ROYAL
ACADEMY,
Fellow of the Royal and Antiquarian
Societies, *&c.* *&c.*

SIR,

NEITHER partiality, nor the expectation of your patronage, as a ſupporter of your brother's opinion, hath induced me to offer theſe ſheets to your protection, being convinced, that not only thoſe of your brother, but even your own opinions, are held in no eſteem with you, otherwiſe than they are conformable to truth; and that you would not heſitate to reject them the moment their fallacioufneſs be proved; a liberality and ingenuity to be found only amongſt *true philoſophers*, and which you candidly endeavour to impreſs on the minds of your pupils, always deſiring them in your lectures, never to truſt to any of your notions, without the ſtricteſt examination, and declaring that you can, with equal pleaſure, renounce any miſtaken doctrine, as maintain the true.

Duty and gratitude are the only motives, which move me to embrace this favourable occaſion of acknowledging to the world, how much I owe both to your knowledge and friendſhip. For me to expatiate on your merits, would only be to leſſen them; the name of Dr. HUNTER ſtands in no need of commendation from my pen; only give me leave, Sir! to aſſure you, that I ſhall always think myſelf happy in finding every opportunity of convincing you, with how much pleaſure, and with what profound reſpect and eſteem, I am,

SIR,

Your very obedient,

And moſt humble Servant,

G. LEVISON.

THE PREFACE.

AS Phyſic is the moſt noble and important ſcience, ſo ought the terms in which it is couched to be the moſt perſpicuous and deciſive. It would indeed be a happy circumſtance, were the profeſſors of phyſic in general, to agree in uſing univerſal terms; many diſputes have ariſen, not only in the ſchools of phyſic, but in almoſt all ſpeculative ſciences, about mere terms only, which, as ſoon as the ideas themſelves intended by the words, have been candidly compared, and the terms defined, opponents agree, and the controverſy vaniſhes immediately.

As long as we remain men, that is, as long as we are not able to diſplay and unfold the true and real nature of things, we ſhall always labour under the burden of controverſy in all ſpeculative ſciences; for the ſame effects will ariſe from cauſes ſeemingly different; and ſince we reaſon of things by their properties only, with which each obſerver will be differently ſtruck, ſome are apt to take for the effects, what others conſider as the cauſes.

The word *life* has often put a ſtop to all reaſoning at once, in both ſciences, phyſiology and pathology; all phænomena

mena are explained rather by a mere word *life*, than by a chymical or mechanical reaſon: the different ſecretions are ſaid to be owing to the different powers of life which each gland poſſeſſes, and that ſtructure is entirely out of the queſtion, where life reſides; though it is very ſurpriſing, that the wiſe creator ſhould have formed each gland differently, when he could make them all alike, and only infuſe in each a different kind of life; but may it not be aſked, why is the power of generation loſt, when there is a defect in either the male or female organs of generation? why did he not make the eye hear, the ear ſee,—— were not the different ſtructure of the organs themſelves neceſſary to perform their different functions, which is mechanical, and were not different attractions of the juices in the different glands, neceſſary to produce their various properties, which is chymical? life is certainly that quality, by which the very ſtructure itſelf is formed, by which it is ſet at work and put into motion, which repairs and ſuſtains it continually; ſo that as ſoon as life is gone, the ſtructure and mechaniſm itſelf is deſtroyed: but this life does nothing of itſelf, without its neceſſary tool, mechaniſm: it is true, that no mechaniſm is ever ſet in motion, without ſome cauſe of life or its operation; but it is alſo undeniable, that life (as far as we know) never operates without mechaniſm. And is it not more conſiſtent with reaſon to ſuppoſe one power of life diffuſed through the whole body, which operates differently in the different parts, according to their ſtructure, than to attribute a different kind of life to each part? We might as well ſay, that each motion, in a different direction of the ſame muſcle, is produced by a different kind of life; both carry the greateſt abſurdity in their face.

It is ſurpriſing, that we always are apt to embrace extremes; thus lately every

thing

thing in phyſic was accounted for merely by mechanics, whereas now, according to ſome, it is ſufficient to know that certain alterations may happen in the body, that certain applications will remove certain diſeaſes, &c. without even attempting to aſſign any reaſon for the different phænomena, forgetting the rule of Celsus, “*rationalem quidem puto medicinam eſſe debere: inſtrui vero ab evidentibus cauſis; obſcuris omnibus, non a cogitatione artificis, ſed ab ipſa arte rejectis.*”

How far the different theories influence a different practice, I ſhall illuſtrate by one inſtance only: when mechanical reaſoning, and the applications of mechanical laws, were the ſole means of explaining all alterations in the animal body, it was certain, according to mechanical laws, ſince all the veſſels of the animal are ſo many tubes which communicate with one another, that when the ſecretion

tion of one ſet of veſſels was increaſed, the ſecretion of another muſt be diminiſhed; a ſalivation conſequently was ſtopped by either the exhibition of cathartics, ſudorifics, &c. whereas according to ſome moderns, the ſalivary glands have ſomething peculiar to themſelves, to increaſe their ſecretion by the exhibition of mercury, which cannot be ſtopped by the increaſed ſecretion of any of the other veſſels.

The doctrine that the blood is alive, though very ancient, *(a)* and largely treated

---

(a) It is repeatedly explained, *Gen.* ix. 4. and *Lev.* xvii. 11. 2. and 14. which I have uſed as my motto, that the נפש *nepheſh*, which ſignifies motion and growth, or increaſe, and which is tranſlated life, has its ſeat in the blood דם *dam*, ſignifying aſſimulation, not in the בשר *baſar*, fleſh or fibres; which cannot be conſidered as accidental, as will appear from the following demonſtration.

treated of by the learned Dr. Wilson in his lecture on the circulation, yet has never

---

The Hebrew has three words expreſſive of life, namely, נפש *nepheſh*, רוח *ruach* and נשם *neſhem*, which I imagine has given riſe to the doctrine of the ancients, concerning three different ſouls; each of theſe three words however denotes a different property, reſulting from the principle life; the firſt נפש *nepheſh* expreſſes growth and motion, the ſecond, רוח *ruach*, breath, and the third, נשם *neſhem*, breathing: the term חיים *chaim*, which is alſo tranſlated life, is quite different from the three fore-mentioned, in its meaning and uſage, ſtanding always by itſelf, and never uſed in regimen of the others, whereas each of them is often placed in conſtruction with חיים *chaim*, which proves that by חיים *chaim*, is not meant the progreſſion or reſult of life, but the principle, life itſelf, which principle is diffuſed through all nature, called by the ancients the *anima mundi*, and which is the foundation of the other three, expreſſing the effects and progreſſions, rather than the principle itſelf: whenever life is attributed to the blood, neither רוח *ruach* nor נשם *neſhem* is joined with דם *dam*, but always נפש *nepheſh*; becauſe the two former רוח *ruach* and נשם *neſhem*, which expreſs breathing and breath, are progreſſions of life, not exiſting in the blood, but on the contrary, give the blood its never been ſo much extended, and ſo many phænomena by it explained, as of late by that indefatigable and ingenious phyſiologiſt, Mr. Hunter, which has given riſe to great controverſy. Dr. Hendy has laboured, in his treatiſe on glandular ſecretion, &c. to refute all the proofs of Mr. Hunter, and to deſtroy the life of the blood, and aſſigns life and action to the ſolids only; which doctrine will fully encourage the abuſe of the lancet in this metropolis, in

---

its power of life; without breathing, circulation is ſtopped: accordingly we find in *Gen.* ii. 7. firſt נשמת חיים *neſhmat-chiam*, *ſufflavitque in nares ipſius halitum vitæ*, and then נפש חיה *nepheſh chia*, *ſic factus eſt homo anima vivens*, ſo that the נפש *nepheſh* is the conſequence of נשם *neſhem*; whereas נפש *nepheſh*, denoting growth and motion, are effects of life, conſiſting in the blood itſelf, and therefore נפש *nepheſh* is always joined with דם *dam* blood, as much as to ſay, "that the growth and motion of the בשר *baſar* fibres "conſiſt in the דם *dam* blood." In another place, I have endeavoured to ſhew that all the Hebrew words are not accidental or arbitrary, but convey with them the very nature and idea of the thing they denote.

in the hands of the ignorant: an attempt therefore, to ſhew that the blood is alive, and that we looſe, as it were, by the loſs of each ounce of blood, an ounce of life, muſt be of the greateſt utility to the publick, and the following ſheets cannot be deemed a mere ſpeculation and uſeleſs theory.

Life then has been conſidered by ſome, as ſubſiding in the fibres, and by others, as exiſting in the blood only; in other words, life has been annexed either to the fluids or to the ſolids of the animal: in order therefore to decide the controverſy, it will be requiſite (that we may not have a diſpute of words only) to define the words that conſtitute the controverſy, namely, what is meant by ſolids, fluids, and life. But ſince we perceive the qualities of things by their actions only, theſe actions cannot be conſidered by themſelves, independent of thoſe bodies they act upon, and their reaction; it will therefore be alſo neceſſary to explain the laws of action and reaction, in living bodies, eſpecially as it ſerves to throw great light upon many phænomena, and as it has not been ſufficiently conſidered, notwithſtanding its great influence upon the practice of phyſic.

Were we to act as empiricks, then certainly the multiplicity of experiments made on living animals, by torturing them, would not only be an infringement upon pity and compaſſion, but throw the greateſt contempt and ſcandal upon phyſiology; in ſo much, that the beſt phyſiologiſt, who indefatigably ſpends his time in making experiments, would be deemed the moſt cruel and mercileſs tyrant, inſtead of being deſervedly crowned with honor and reputation, for his obſervations that tend to diſcover the knowledge of diſeaſes and their cure.

It would be indeed a mere play of words, and a uſeleſs tautology, were the conſe-

quence

quence and reſult, of all the experiments made on the blood, only to ſhew its dignity, and to honor it with the name of life; and the controverſy of phyſiologiſts on that ſubject, would deſerve no more attention, than the quarrel of children about a name: but that is far from being the caſe; on the contrary, the obſervations on the blood have ſo great an influence upon the practice of phlebotomy, that I wonder, the ſtate of the blood itſelf in V. S. ſhould not be more regarded. The late ingenious Mr. Hewson, in his experimental inquiry on the blood, has thrown out many uſeful and practical obſervations on that ſubject. I ſhall therefore only take notice of what he has either left untouched entirely, as concerning the red globules, or what, as he himſelf ſays, he was not able to explain; and the whole will be divided into ſix ſections; 1. of ſolids, fluids, and vapor; 2. of action and reaction; 3. of life; 4. of the life of the blood; 5. of phlebotomy; 6. of the red globules.

I am far from imagining, that the hints which I here throw out will eſcape all objection, yet I hope they will not be treated with the ſeverity of criticiſm, but with the generoſity of candor, even ſhould ſome of them be found fallacious; for many true diſcoveries have been inveſtigated by the means of ſome new, even falſe opinions ſtarted; and many precious and noble edifices have been raiſed upon the ruins of others: if that ſhould be my caſe; if this eſſay ſhould excite men of real knowledge, and who have more opportunity of purſuing the ſubjects, by experiments, with more accuracy than my capacity is able to reach, and then either approve or deſtroy my conjectures; I ſhall, in both caſes, think my labour well paid, and amply rewarded.

ERRATA.

Page 7. line 16. for *of ſelway,* read *of the,* &c.
39. Note *(u)* l. 11. for *tubes,* read *tube.*
50 l. 2. for *motion is,* read *motion or is.*
88. Note *(ii)* l. 1. for εχȣ́σῃ υπό, read ἐχȣ́σῃ ὑπὸ,
l. 2. for ληφθῆνα, read ληφθῆναι.
92. Note *(ll)* l. 3. for *which run between the bones,*
read *between which the bones run.*

CONTENTS.

SECT. I.

OF SOLIDS, FLUIDS and VAPOR.

Page

ALL bodies appear under either a ſolid, a fluid, or vapor — 1

An objection againſt Dr. FORDYCE's definition of ſolids, fluids, and vapor removed — — 2

The univerſe is kept in motion and exiſtence, by the two oppoſite attractions, that of coheſion and gravitation. In the circulation of the blood, two oppoſite powers are obſervable, the ſame as in nature in general 3 and 4

Solids, fluids, and vapor, are in a continual change — — 4, 5

CONTENTS.

Page
How this change may be produced, note (*c*) Page 5
The opinion of ARISTOTLE is the ſame with that of the moderns, only differently expreſſed — — 5
The ſituation of the ſolids, fluids, and vapor, muſt remain undetermined — 6
The ſolids and fluids in the animal undergo the ſame changes as thoſe in nature 7
The great connection between mind and body — — note (*d*)
The different ſecretions in the animal might be accounted for, if we underſtood the laws of motion and changes in nature — — 8
Growth and granulation is produced by the changing of ſome parts of the blood into ſolid veſſels — — 9
Some parts of the animal are continually evaporated, whilſt others acquire a greater conſiſtence — — 10
Other ſyſtems of nature take in what the animal throws off — ibid.
The operations of nature are ſimilar to thoſe of the animal body — — 11

The

Page
The ſituation of ſolids and fluids in the animal is undetermined —— 11
Mixture the delight of nature —— 12
The effect of mixtures in medicines —— 13
Theory is cloſely combined with practice 14

SECT. II.

OF ACTION and REACTION.

To perception and motion, both action and reaction are neceſſary —— 15
Why the ſame objects will operate differently in different circumſtances 16
The great concern the law of action and reaction has with phyſic —— 17
The phænomena of fevers explained by action and reaction —— 18
The operations of medicines by the laws of reaction — — 19, 20
No inference to be drawn from the operations of medicines, in a ſound ſtate of the body, to their effect in its diſeaſed ſtate — — — 21
All pleaſure and pain excited by reaction 21, 22
Why ſometimes weak, and at others ſtrong

Page
parts, will be more affected by applications — — 22, 23

SECT. III.

Of Life.

What bodies are called dead, and what living — — — 25, 26
The ſtriking properties of living bodies, 27, 28, 29
There is either a repulſive or aſſimulating power in the motion of bodies — 30
Life claſſed under three general kinds — 31
Three kinds of motion — — 32, 33, 34
Uterogeſtation a proceſs of life — 35
The fear of the inferior animals to the ſuperior, by the power of life — 35, 36
The different gradation of life — note (*t*)
Living animals produce both cold and heat Page 37, 38
Different ſubſtances converted into one and the ſame nature, by the power of life — — 38, 39
In what manner medicines may operate note (*u*)
Digeſtion a power *ſui generis* — Page 41

Page
Living ſyſtems preſerve themſelves without exertion — — 42

SECT. IV.

OF THE LIFE OF THE BLOOD.

Life exiſting in fluidity and motion — 43
Why the blood may be called alive — 44
The phænomena of the blood's remaining in a fluid ſtate when in, and coagulating when out of the veſſels, are accounted for by its living principles, 45, 46, 47, 48
Dr. Hendy's objections to the proofs of Mr. Hunter examined — 48
The vigor of vegetation conſiſts in the juices of the tree and in its life — 49 to 60
The ſecond proof of Mr. Hunter — 60
The third proof of Mr. Hunter and Du Hamel's caſe explained — 62, 63
The adheſive inflammation occaſioned by the ſurrounding living fluids — 64
An obſervation of Dr. Hunter — 65
The principle of coagulation owing to the irritability of the blood — 67
The fourth argument of Mr. Hunter — 68
The fifth argument, and the difference be-

tween

Page
tween the coagulation of a jelly and that of the blood, and the ſixth argument — — — 69, 70
Any living animal dies the ſooner, the ſtronger it reacts — 71
A difference between irritability and weakneſs — — 72
Whether the blood coagulates only by ſtimuli — — 73
The ſeventh argument — — 74
A difference between the anaſtomoſation of nerves and that of blood veſſels, 75, 76
Each ſet of nerves has a particular office, 76, 77
The laſt objection of Dr. Hendy removed 78

SECT. V.

Of Phlebotomy.

A difference between a real plethora and a ſudden repletion, occaſioned by repeated V. S. — — 79
A general relaxation will be produced by repeated V. S. — — 80
How the ſtate of the fibres may alter the properties of the blood, 81, 82, 83, 84
The ſizy cruſt a miſleading indication of V. S. — — — — 85
The ſizy cruſt is the ſymptom, not a diſeaſe itſelf — — — 78

The

Page
The danger of repeating V. S. in pregnant women — — 88
It is better to bleed a little, and repeat it, and pay attention to the ſtate of the blood, than draw off a great quantity of blood at once — — 89

SECT. VI.

OF THE RED GLOBULES.

The red globules a compoſition of earthy and oily ſubſtances — - 90
The two different oſſifications between membranes and cartilages explained, 92, 93
A ſuppoſition that oſſification goes on continually, even after growth — 94
Gravelly and calcarious complaints, occaſioned by a fault in the oſſification, owing to the ſtate of the red globules — — 95, 96, 97
The pain in the gout explained — — 99
Some diſeaſes may be produced by the want, and others by the abundance of the red globules — — - 100

Publiſhed by the ſame AUTHOR,

A
DISSERTATION
ON THE
LAW and SCIENCES;
In HEBREW.
QUARTO.
Price FIVE SHILLINGS.

THE
The SPIRIT and UNION of the
Natural, Moral and Divine Laws.

Price Two Shillings and Six-pence.

ON THE BLOOD, &c.

BOSTON MEDICAL
AUG 15 1927
LIBRARY

SECT. I.

OF SOLIDS, FLUIDS, AND VAPOUR.

SOLIDS, fluids, and vapour, are the three moſt ſtriking objects we perceive in all bodies, and in nature; every ſubſtance appears under one or other of theſe three. The moſt correct and general definition of ſolids, fluids, and vapour, is that of the accurate and learned Dr. GEORGE FORDYCE; *(b)* namely, bodies, whoſe attraction of coheſion is ſtronger than that of gravitation, are called ſolids; ſuch bodies whoſe attraction of gravitation overcomes that of coheſion, are called fluids; bodies which can be condenſed into fluids, are called vapours.

There has been an objection raiſed againſt this definition; namely, that it is giving only the cauſe and the means by which bodies are ſolids, or fluids, not the real diſtinct ſigns of the appearances; which ſhould always be the aim and uſe of every definition; but it has perhaps not been ſufficiently conſidered, that by attraction is meant an effect, or the appearances of bodies with reſpect to their relative ſituation; which appearances are objects of ſenſe, not the power or cauſe by which that attraction or effect is performed;

(b) Chymical Lectures.

formed; the cauſe itſelf being occult, may be an impelling one: now then, according to the attraction of coheſion, the ſolidity of a body will be encreaſed; as the contrary effect, namely, fluidity, will be produced by that appearance, called attraction of gravitation prevailing over that of coheſion; which is the tendency of each particle of a body, to another center, and as it were tearing itſelf from the center of that body to which it belongs. By theſe two oppoſite attractions, or conſtant action and re-action, the univerſe is kept in motion and exiſtence. How theſe oppoſite motions are produced alternately, I do not pretend to determine; ſufficient it is, that ſuch motions are perceptible in the univerſe, and its parts.

In the circulation of the blood, we obſerve, that the power which produces the motion of the lacteals, veins, and their contents, in bringing the chyle and blood to the right auricle and ventricle of the heart, cannot be equal to that motion with

with which the blood is expelled again from the left ventricle into the *aorta*, to all the extremities; nor can either of theſe two motions be ſo ſtrong as entirely to overcome the other; for in both caſes, circulation would ceaſe; each motion therefore muſt always, by ſome means or other, probably by reſpiration, alternately gain a new force to keep up the circulation: the ſame may hold good of the motion in the planetary ſyſtem and their particles, as in each particle of the blood and veſſels.

In conſidering ſolids, fluids, and vapour, we ſhall often find them ſo changeable and blended, as not to be able to determine either their ſituation or nature. The conſtant alternate motions of the planets, or the two different attractions, produce the continual change of fluids into ſolids, ſolids into fluids, and theſe into vapour, and the reverſe; *(c)* thus ſome bodies, which, while they remain in the bowels of the earth, are ſolids, when exhaled in the form of vapour, become fluids in the atmoſphere, which is very perceptible in moſt of the acids, &c. ARISTOTLE, though not well acquainted with the real properties of bodies, yet ſeems to teach this doctrine, when he ſpeaks of his four elements, earth, water, air, and fire, as changing continually into one another; moderns maintain the ſame, though they expreſs it in other words, when they ſay, that " the different pro-

---

(c) Which may eaſily be underſtood, if we ſuppoſe any aggregate of infinite ſmall elaſtic particles, preſſed continually upon a certain center, and repelled again from it, that by that motion ſome of the ſmall component parts, are always preſſed out of that aggregate in the form of very ſmall particles, ſo as to aſſume the appearance of fluids and vapour; whilſt others, which are ſqueezed towards the center, acquire a greater conſiſtency and ſolidity, by the force of cohesion, and take on the appearance of ſolids.

“ perties of bodies are owing to the “ different combinations of their integrent “ parts.”

If we conſider the ſituation of ſolids and fluids in the univerſe, we hardly can determine, whether the fluids run through the ſolids, or whether the ſolids are plunged into the fluids: thus, according to one appearance, we may ſay all the ſolid planets move in the air or æther; and with reſpect to another appearance, we may, with the ſame propriety, ſay that the æther or air is diffuſed through them: but if we take both appearances together, we ſhall find the ſolids and fluids ſo united and blended into one another, that we ſhall be at a loſs, which of the conditions to aſcertain; and we ſhall find that there are no real ſolids nor real fluids to be found; and that we only uſe theſe terms to diſtinguiſh bodies according to their different appearances.

If we apply this reaſoning to the animal body, we ſhall find that its ſolids and fluids are equally united, and undergo the ſame changes as thoſe in nature at large, ſo that no alteration in the animal body can be accounted for by the ſtate of its ſolids, or fluids only; *(d)* and I do not doubt, but that

---

(d) Not only the apparent ſolids and fluids in the animal œconomy are cloſely connected and reciprocally affected by each alteration; but alſo the mind is cloſely connected with the body, ſo that many diſeaſes of the ſtomach have their origin from the ſituation of the mind, and the mind again is affected by the circumſtances of the ſtomach. A head-ach will very often be cured by an emetic; a chearful mind will increaſe the appetite, and the digeſtive power. In conſequence of certain ideas being excited in the mind, an increaſed action of the nervous influence, will follow upon the muſcular fibres of the ſtomach, and it will be affected with nauſea and vomiting; and that idea will ſtimulate the ſtomach the ſame as a doſe of *ipecacuanha* or emetic tartar; the ſight or remembrance of grateful food, will increaſe the ſecretion of ſalivary glands; all the hypochondriac and hyſteric

that if we underſtood rightly the laws of motion and changes of nature in general, we might eaſily account for all the different ſecretions and motions in the animal body: for which reaſon the ancients called man a microcoſm. Each part of the animal body is in a perpetual, though inſenſible motion, by which motion it converts

---

hyſteric ſymptoms are often the effects of an uneaſy mind, and when they are the effect of a ſedentary life, the mind is always ſecondarily diſturbed. Thus then the ſtomach, which is the firſt means of affording nouriſhment to the body, and generating all the groſſer parts of the fluids, and the mind, which is the firſt elaboratory of the finer parts of ſolids and fluids, are ſo blended into one another, that we need not wonder when diſeaſes are miſtaken, by ſearching for their cauſe in the one, whilſt it is ſituated in the other: and we may add, that every phyſician ſhould alſo be a metaphyſician, that is, he ſhould underſtand the mind and its diſeaſes, as well as thoſe of the body. In another place I have endeavoured to ſhew how both ſciences, phyſics and metaphyſics, are one and the ſame: *Vide*, the Spirit and Union of the natural, moral, and divine Law. Page vi.

converts continually ſome ſolid parts into fluids, and theſe into vapours, and the reverſe; the former is evident from all the different evacuations and inſenſible perſpiration, and the latter from growth and granulation: that growth is effected by the change of the parts of the blood into the ſolid veſſels, is evident from the great quantity of blood which is found in the arteries, as long as growth continues; whereas in old age more blood is found in the veins; granulating fleſh can be nothing but a maſs of fluids changed into ſolid parts, and as Mr. HUNTER juſtly ſuppoſes, the coagulable lymph. The coagulable lymph itſelf, which may juſtly be called a ſolid, took its origin from a fluid, the chyle. Air taken into the lungs is mixed there with the blood, alters its nature, and becomes more fixed than reſpirable air: the food, which is carried down to the ſtomach by the contractile muſcular power of the œſophagus, is by a ſimilar exertion of muſcular power, carried from the ſtomach againſt its gravity, through the different convolutions of the inteſtinal tube, and conveyed out of the body; while, by a ſimilar motion of the ſmaller veſſels in the meſentry and inteſtines, the chyle is carried to the thoracic duct, from thence to the veins, where it acquires a greater conſiſtency, and from the veins into the arteries. By that conſtant motion and change, ſome parts of the animal body are continually evaporated internally and externally, whilſt others acquire a greater conſiſtence; which makes it very probable, that ſome parts of the blood are changed into parts of veſſels, and parts of veſſels into the form of vapour.

All the parts, which are thrown off from the animal body, are taken in again by other ſyſtems of nature, (with the ſame motion as they were at firſt taken into the animal body) and become parts of them; where they undergo various changes, 'till they are thrown off again from theſe ſyſtems, and aſſumed by others, and ſo on: by theſe means nature in general carries on life, while its parts or individuals are firſt generated by the whole, and then, as it were, by it devoured again; for which reaſon, ARISTOTLE in defining the world ſaid, "It is the con-"ſtant production and deſtruction of "things."

Thus then the operations of nature through the whole, are ſimilar to thoſe of the animal body upon its parts.

Again, with reſpect to the ſituation of the ſolids and fluids in the animal body, it muſt remain undetermined, the ſame as in nature; ſince I may ſay, according to one appearance, the ſolids are immerſed into the fluids of the animal; becauſe the veſſels, and each of the *vaſa vaſorum,* are not only filled with fluids, but the whole body is ſurrounded with its own vapour, and has its own fluid atmoſphere; and, if I conſider another appearance, I may reverſe the poſition; but taken both together, we ſhall find, as in nature, that no real determination of the permanent ſituation of ſolids, fluids, and vapour, can be fixed; and that theſe three principles run continually into one another, and each of them is in conſtant motion, and continually changing.

Theſe three principles, ſolids, fluids, and vapour, are in nature mixed together; it is mixture in which, as it were, nature finds delight, by which it produces and deſtroys continually. There is nothing perhaps ſimple in nature, nor do theſe objects which appear ſimple, affect either the animal body or the mind, in ſuch a degree as compounds do. We are ſoon tired of the ſimilarity of objects; and, concerning the paſſions, I have ſhewn in another treatiſe, *(e)* that mixed paſſions are the ſtrongeſt. The learned Dr. FORDYCE obſerves, *(f)* that mixtures of medicines are generally both more ſalutary and efficacious in their operations. *(g)* Dr. LEWIS, in his materia medica, relates that he found fifteen grains of jalap, mixed with two grains of ipecacuanha, proved more efficacious than twice that quantity of jalap by itſelf; and I have found the ſame in the mixture of alteratives, deobſtruents, or relaxants (as ſome moderns call them) the trial of which is recommended by Dr. FORDYCE in his lectures; and indeed many other

---

(e) *Vide*, the Spirit and Union of the natural, moral, and divine Law. Page 203.

(f) In his Lectures on the Materia Medica.

(g) In the conducting of this part of medicine, Phyſicians have always run to one of the extremes; the ancients mixed millions of medicines, whereas ſome moderns prefer mere ſimples.

other mixtures might be tried with ſucceſs: all which proves alſo, how cloſely theory is combined with practice: we find in theory, and in conſidering nature in general, what powers are produced by mixture, and we find the ſame in the practice of phyſic.

SECT II.

OF ACTION AND REACTION.

ALL animals are ſet in motion or excited to perceive, and men to think by the reciprocal action and reaction between them and ſurrounding objects; becauſe in order to perceive, or have an idea, it is not only neceſſary, that external objects ſhould operate upon the animal, but that the animal alſo ſhould operate in ſome meaſure upon them, otherwiſe perception is hindered. Thus if ſome objects are repreſented to our eye, while we are engaged with others, we do not perceive them at all; it is the ſame with ſounds upon the ear, taſtes to the tongue, &c. Whatever excites the animal to any action is done by certain properties of the objects; which properties act by certain laws according to the properties of the animal they operate upon, and therefore we ſhall often find, that one and the ſame application will operate differently upon different animals, nay even upon different individuals belonging to one ſpecies, it will even differ in the ſame animal under different circumſtances, all which muſt be accounted for by the diſpoſitions of the animal, and its reaction. Thus will ſome harmonies excite different paſſions in different animals, or in the ſame animal at different times: a colour, which ſeems pleaſing to one animal, will be diſagreeable to another, the ſame with reſpect to taſte, ſmell, &c. We find this diſtinction even in the effect of mere ideas; a fright, for inſtance, will in one perſon encreaſe the ſecretion of ſeveral glands, ſtimulate the inteſtines ſo as to diſcharge their contents, and in others it will have juſt the oppoſite effect; all which is owing to that great general law of nature, I mean action and reaction. In order then to perceive any ſubject rightly, both action and reaction muſt be proportioned. If the reaction be ſtronger, the object will not appear at all, as is the caſe in ſmall objects, but when proportioned they will as it were unite, and the intention of nature will be performed. This law has ſo great an affinity and concern with phyſic, that not only all the phyſiological changes in the animal body, but even all its alterations in a diſeaſed ſtate, the application of medicines, its experimental philoſophy, &c. cannot be adjuſted without conſidering the reaction. *(b)* Thus the

---

(b) Dr. HENDY, in his treatiſe on glandular ſecretion, concludes, "that pus does not act as a ferment; "becauſe a piece of mutton which he introduced into "an ulcer of a leg producing pus, was not converted "into pus"; forgetting that pus acts as a ferment only in living parts by their reaction, and that a ſlice of mutton may be conſidered as a piece of wood, both being dead parts, not affording any reaction.

the proximate cauſe, or the firſt ſtriking appearance of almoſt all fevers, is a debility, which is a ceſſation of motion or languor, and which is, or by which the cold ſtage is produced, agreeable to what we perceive in nature in general, where cold and reſt are coexiſting qualities; the denſer a body is, that is to ſay, the leſs inteſtine motion its integrent parts poſſeſs, the colder it is, which is evident in different minerals and ſtones. Upon the cold ſtage of a fever, the hot paroxyſm follows by the reaction and encreaſed motion of the veſſels, and their contents, which paroxyſm, or reaction, is always proportioned to the action or the cauſe of the fever, or to the cold ſtage, to the degree of tremor and the degree of the debility; the anorexy nauſea vomiting, in the cold ſtage, is alſo owing to the reaction of the ſtomach and the internal veſſels, reſiſting the preſſure made upon them by the contraction of the external veſſels. In this manner we may rationally account for many other ſymptoms. *(i)* The ſame law of re-action holds good in the operation of medicine. *(k)* The ſame medicine

---

(i) An emetic exhibited in the beginning of a fever, even putrid, (*vide*, Sir J. PRINGLE's Obſervat. pag. 306.) will finally put a ſtop to it, by exciting the re-action of the ſyſtem, either to expel the morbid matter, or to remove the contraction; in the ſame manner will antimonials, ſo given as only to excite a continual nauſea, prevent the paroxyſm of fevers, by ſlightly re-acting the morbid matter, or the contraction which inſinuates itſelf gradually into the ſyſtem, and at laſt produces the paroxyſm; and I ſhould imagine, that medicine in general act only by exciting ſome re-action of the ſyſtem, to expel, remove, or counteract the diſeaſe; not that there is any ſpecific virtue in any medicine itſelf.

(k) Opium will, in ſome circumſtances of diſeaſes act as a corroborant, procure ſleep, and haſten the cure; (*vide*, the learned Sir J. PRINGLE's Obſervations, page 132) whereas it will have quite the contrary effect in other diſeaſes, and in a ſound ſtate; all which muſt be accounted for by the re-action of the ſyſtem, not by the action of the opium alone. And hence the hurtful conſequences of all unneceſſary medicines, by exciting a preter-

medicine will produce ſometimes quite the oppoſite effect in a ſound ſtate of body,

to

---

a preternatural reaction in the ſyſtem, and making it, not only, as it were, at the ſame time neglect its natural actions, requiſite to preſerve health and life, but produces alſo, by that preternatural exertion, a future debility, which renders the ſyſtem unfit to continue its natural functions. Some phyſicians are hence led to conclude, that nature muſt cure all the diſeaſes, and that medicines are entirely uſeleſs; but they forget that our preſent manner of living is not a natural one, and that we are no more the natural man; ſo that we muſt often have our recourſe to art, in order to re-act the diſeaſes produced by art: animals and ſavages who live entirely according to the dictates of nature, ſtand ſeldom in need of medicines, phyſical evils being very few; but men, civilized by art, have broken, as it were, their alliance with nature, by oppoſing it continually; and therefore, when a diſeaſe takes place, they muſt firſt expel the enemy by artificial application of medicines, before they can expect the cure of nature. Vitiated demands may often be miſtaken for calls of nature; under certain circumſtances, there will ſometimes be a falſe appetite, owing to a diſeaſed ſtate of the ſtomach and inteſtines; if that call be ſatisfied, the diſeaſes will only increaſe: but in this and the like

caſes,

to what it does in a diſeaſed ſtate, and ſo in different diſeaſes; hence the miſtake of ſome, who, by trying the effects of ſome medicine upon themſelves in a ſound ſtate, would infer the ſame to be their effects when applied to a diſeaſed body.

It is, I believe, beyond doubt, that we acquire our firſt ideas by reſiſtance; we are reſiſted upon our ſenſes by all external objects, in our firſt entrance into the world, and we endeavour to perceive the things that reſiſt us, and to react upon them; were we merely paſſive, without reacting, we could have no ideas. All pleaſure and pain are excited, and felt more or leſs, according to the degree of reaction, which degree of reaction conſtitutes the degrees of pain or pleaſure.

If

---

caſes, art is wanting to remove the cauſe of that falſe appetite, and then certainly nature will finiſh the cure; but not that nature is to be left to itſelf, when it has been hindred in its functions by corruption or art.

If harmonious ſounds ſtrike my ear, when my attention is taken off, no pleaſure will enſue, nor will pain enſue under the ſame circumſtances, by diſproportioned and noiſy ſounds. The pain which we feel from cold applied to any part of the body, is excited by the preternatural exertion of the part, to produce heat and react the cold; the pain will increaſe the more we think on it, that is, the more we endeavour to react it.

The cutting of a ſtrong muſcle will be far more painful than that of a weak one, the former being ſtronger, and conſequently reacting more to the cut, than the latter, and therefore, when the muſcle is once cut through, and conſequently no more reaction, the pain ceaſes entirely; there is now and then to be obſerved, that ſome applications on weak and irritable parts will cauſe great pain, whereas on ſtrong parts, no ſuch ſenſation will enſue; but even that muſt be accounted for by the reaction. A ſlight touch on a ſtrong part will not be ſenſible or reſiſted at all, and therefore will not excite reaction; but that very touch to a weak or irritable part will threaten its deſtruction, and will be ſo ſenſible to it, as to excite reaction; irritability itſelf is nothing elſe but the reaction of ſenſible parts to any reſiſtance: moſt membranes are irritable. The influence of the imagination in theſe caſes, which we know may diminiſh or increaſe the pain, is alſo to be accounted for by the reaction. A bliſter applied to a ſound part, will cauſe inflammation and great pain, which is certainly owing to the reaction of the parts; ſince the ſame, when applied to a relaxed or paralytic part, will not have the ſame effect. Pain itſelf, which attends all inflammation, is owing to the reaction of the ſmaller veſſels to the blood, which is continually impelled on them; and therefore, by relaxing the parts inflamed, and taking off that tention and reaction, an inflammation will often be cured.

All application of medicine act according to the reaction of the parts they are applied to; and there are no medicines, ſtrictly ſpeaking, poſſeſſing any quality not relative to the parts and their circumſtances, they are applied to.

SECT. III.

OF LIFE.

ALL bodies are diſtinguiſhed, and conſequently differently named by the different impreſſions they make on our mind, according to their properties; we call thoſe bodies alive, which ſtrike us with properties peculiar to themſelves, and not to be found in other bodies which we call dead.

Bodies, therefore, that poſſeſs ſome properties, by which they are diſtinguiſhed from dead bodies, we call living. We ſay vegetables and animals are alive, becauſe they have qualities which do not appear in minerals: to denominate any thing alive, we muſt diſcover thoſe properties,

perties, in which it differs from minerals, and correſponds with vegetables or animals; the more properties of the latter it poſſeſſes, the more it has right to be ranged under the claſs of living bodies: our firſt buſineſs is therefore to point out, and enumerate all the properties, by which bodies are ſaid to poſſeſs life, and then to ſearch for thoſe properties in bodies, the life of which does not ſtrike us immediately, and if we find them poſſeſs ſome of the living qualities, we need not heſitate to call them in ſome ſhape alive.

The moſt ſtriking properties of bodies we call alive, are the following: 1ſt, *Self Motion.* *(l)* All dead bodies continue at reſt 'till they are impelled by others, when they begin

---

(l) Inanimum eſt omne quod pulſu agitatur externo; quod autem eſt animal, id motu ſcietur interiore et ſuo. Nam hæc eſt propria natura animi atque vis: Cicero Diſput. Tuſcul. lib. 1.

begin to move in ſuch a direction, as they are impelled to; but bodies alive, poſſeſs a continual inteſtine motion within themſelves, without the impelling cauſe being ſenſible: I ſay ſenſible; for I think there muſt be a continual impelling motion, to produce the motion of living bodies, though the cauſe may be inſenſible. 2d, The *conſent* and *co-operation* of the parts, to promote the continuance and health of the whole; as ſoon as that co-operation is loſt in any part of the ſyſtem, a diſeaſe is produced; it is by that property, we call a muſcle alive as long as it contracts alternately, by the application of a ſtimulus, even after it is ſeparated from the living body; becauſe it contracts by the conſent of the whole, though only one part of it is ſtimulated. *(m)* By the

---

(m) The cauſe of that kind of life, is a matter of diſpute. HALLER thinks it is owing to the glutinous matter

the ſecond quality, a third is produced, that of *aſſimulation*; living bodies continually take in other ſubſtances, and render them homogenous to their ſyſtem. A fourth is alſo produced; that of *reſiſting* and *reacting* to any heterogenous body that threatens to deſtroy it. A fifth quality, owing its origin alſo to that of conſent and aſſimulation, is that of the *conſtant converſion of ſolids into fluids, and fluids into vapour*, and the reverſe: thus ſolid food taken into the body, is converted by the power of digeſtion into a fluid, the chyle, and blood, &c. After ſome parts of theſe fluids have nouriſhed the body, others are exhaled, both internally and externally, in

---

matter connecting the earthy particles, of which the fibres are compoſed, which opinion has been refuted by Dr. WHYTT, in his phyſiological eſſays; but I ſhould imagine, we never ſhall be able to determine cauſes, which are not objects of ſenſe, and we ſhould only take notice of the effect, which is juſtly called by modern phyſiologiſts, a living principle, to diſtinguiſh it from the effects of dead bodies.

in the form of vapours: fluids which are taken in, are changed into a more ſolid form, the chyle; that again is converted into blood, a part of which, the coagulable lymph, is a ſolid; and it is very probable that the ſolid parts of the blood veſſels themſelves are inſenſibly formed from the blood, namely, the coagulable lymph, whilſt others are thrown off. The change from fluid parts into ſolids is evident enough, from the circumſtances of growth and granulation, and from every appearance of nature, ſimilar to that change in the univerſe where we ſee that continually ſome parts of the ocean are changed into parts of the earth, whilſt many parts of the earth are converted into the ocean.

All the above mentioned properties and powers are done by motion; the motion of bodies therefore ſeems to be of ſuch a nature, as either to repel other bodies which come in contact with them, and are heterogenous, or to unite with and aſſimulate them, that is, to render them homogenous. The repulſive power is evident in all natural bodies in general; and that power of aſſimulation, in the vegetable and animal ſyſtem in particular. Vegetables and animals when in contact with bodies which they cannot aſſimulate, endeavour to repel and deſtroy them by reaction, (ſect. 2.) and when not ſtrong enough, they are, by their own reaction, (ſect. 2.) and the action of thoſe bodies, deſtroyed. Thus is food taken into the ſtomach and aſſimulated by the whole ſyſtem, but if any thing enters the ſtomach which tends to deſtroy it, the ſtomach endeavours to react and throw it either out, or is, by that very reaction, and the action of the heterogenous body, deſtroyed. All this is done by motion and life; by motion, I mean the external appearance of the body with reſpect to its place; and by life, the internal power which promotes that motion.

Life may be claſſed under three general kinds; 1ſt, the life of a ſyſtem in general, as that of an animal or vegetable; 2d, the life of its parts when taken from the whole, as a muſcle, a twig; and 3d, volition, or the ſoul, which laſt differs according to the different organization of the animal, (n) and is rather the ſubject of metaphyſics, which I have en-

---

(n) I would not be underſtood here to hint at the repugnant doctrine of *materialiſm*; on the contrary, I cannot imagine how the certain ſituation or arrangement of the various parts of the body ſhould be able to produce ſenſe or reaſon. "*Membrorum vero* "*ſitus et figura corporis, vacans animo, quam poſſit* "*harmoniam efficere non video.*" *Cicer. Tuſcul. Diſput. Lib.* 1. We certainly muſt ſuppoſe the exiſtence of a mind, but nevertheleſs that mind ſtands in certain unknown relations and connections with the organization of the body it enlivens and perceives ideas according to the nature of the mechaniſm in the organs of the ſenſes, by the impreſſion and action of the ſurrounding bodies upon them, and their reaction (ſect. 2.), which has given riſe to LIBNEZE's doctrine of the pre-eſtabliſhed harmony.

endeavoured to explain in another place. Accordingly there are three kinds of motion; 1ſt, the motion of the ſyſtem, or original motion, which is nearly circular; *(o)* (ſect. 1.) all its parts repelling equally from

---

(o) By circular motion I mean, that there is a certain center in the ſyſtem, which may be called the grave center, to and from which all the parts move continually, and conſequently form by that motion a circle: that motion when it is, by ſome cauſe, inverted, ſo that thoſe parts which ſhould move towards the center and be aſſimulated, move from it, and others which ſhould move from the center and be exhaled, are impelled towards it, then convulſions take place, ſuch as are produced by a fright, or by the application of ſtimuli, which, by exerting the parts to react, confuſe the natural motion from and to the center. That ſome ideas are capable of ſetting the whole ſyſtem in a convulſive motion, is not ſurpriſing at all, ſince we ſee the ſame effect of the will in a ſound ſtate; I mean the act of jumping, which is done by the will ſetting the grave center of the ſyſtem, the pelvis and its muſcles in motion to a certain direction, ſo that the whole body is ſet in motion and is lifted up.

from all ſides in an alternate motion, to and from the center; ſuch are the motions of the planets, animals and vegetables; which motions are original, *(p)* and always con-

---

The vermicular motion of the inteſtines, to preſs downwards the excrements, which is made by the contraction of the ſpiral fibres, and hence called periſtaltic, is not peculiar to them; for the motion of the blood veſſels ſeems to be of the ſame nature, by contracting continually their ſpiral muſcular fibres, and propelling the blood. The ſtructure of the different coats of the blood veſſels, which are fibres, ſpread longitudinally and latitudinally, when ſet in motion, form evidently that kind of vermicular motions which is ſo ſenſible and evident in the inteſtinal tube; and I ſhould be apt to conclude, that all motions in the animal fibres are of the ſame nature; ſome particles move to, and others from the center in all directions, and form both a circular and vermicular motion.

(p) When I ſay original motion, I mean a motion where its cauſe is inſenſible, or is not an object of ſenſe; for metaphyſically conſidered, there muſt be ſome cauſe even for the original motion which depends on life, and that cauſe muſt communicate the motion, or repel it conſtantly.

nected with the continual change of the three principles, ſolids, fluids and vapour: (ſect 1.) 2d, the motion of parts; and 3d, the inviſible motion, or that of the mind. (q)

Many other phænomena appear in living ſyſtems not eaſily accounted for by mechanics, ſuch as for inſtance, that power by which the ſyſtem is firſt produced, and then generated by ſeeds. The famous Dr. HUNTER, in his anatomical and phyſiological lectures, ſhews by many proofs, that utero-geſtation is not done by any mechanical power, and that the uterus is not dilated by by the bulk of the fœtus; one of his proofs is very ſtriking, he found the uterus dilated when the *corpus luteum* and the impregnation was only ſeen in the *ovaria*: he affirms therefore, that it is a proceſs of life *(r)* which dilates the uterus, and produces the *placenta* and its veſſels for the nouriſhment of the fœtus.

(q) That the mind performs its operations, thinking, concluding, &c. by motion, no one can doubt; becauſe thought is the conſtant preſentation of ideas which are acquired by objects; by the images of which we think, and which images we conſtantly move in our imagination, as it were, from one place to another, by comparing ſome and finding differences between others. (See the ſpirit and union of natural and moral divine law. Lect. 10.)

It is by that power of life, that the inferior ranks of animals are afraid of the ſuperior, which cannot be owing to figure or bulk, ſince as ſoon as a man is dead, that fear is gone *(s)* though his figure

---

(r) This proceſs may be owing to the uterus being ſtimulated by the impregnation; the ſtimulation cauſes a determination of blood to the uterine veſſels, as a proviſion and habitation for the fœtus, and enlarges the ſize of the uterus during pregnancy, its veſſels being diſtended and filled with blood.

(s) RABI SIMON, ſon of ELIESAR, ſays "A living "child, of one day old, guards itſelf from the mice; "whereas

figure remains the ſame; and many animals, of greater bulk than man, are afraid of man, which fear ſeems to be excited in them by the higher degree of life man poſſeſſes. (t) It is with that power

---

"whereas Og the King of Baſan (the greateſt giant) "muſt be guarded from them;" becauſe it is ſaid, *Gen.* ix. 2. "And your fear, &c." as long as a man is alive, his fear lies upon all creatures; but as ſoon as he is dead, that fear vaniſhes. Talmud. Shabatt. Sect. Haſoel. fol. 151.

(t) I muſt remark here, that though the gradation, obſerved in the univerſe, from the loweſt claſs of minerals, to the higheſt claſs of animals, men, is ſo obvious, that it has ſtruck all the ancients, the Jewiſh writers, the Kabaliſts, and PLATO eſpecially, who have extended it ſo far, as to trace by analogy, other beings, as angels, &c. to the omnipreſence himſelf; yet, I think there is a material and eſſential difference between different beings, though they may be gradually traced as a chain. That very thing or quality, which diſtinguiſhes one being from another, makes it alſo eſſentially different: vegetables are ſaid to be alive, yet there is the moſt material and eſſential difference between the power that the animal produces, as ſome moderns expreſs themſelves, both heat

---

the life of the higher claſs of vegetables, and that of the lower claſs of animals; and ſo there is between the higher claſs of animals, and the lower claſs of men, as there is alſo between each degree: we diſcover a ſimilitude between different beings, and a chain in the whole creation; we find the ſame quality, which the lower degree of beings poſſeſs, is alſo connected with beings of a higher degree; but that very quality, which we think they have in common, muſt be eſſentially different in both, its being in the higher degree combined with another, with which it could not be, were it not quite different; and why ſhould not the lower degree poſſeſs it alſo, were there not a material difference between the nature of even thoſe qualities they are ſaid to poſſeſs in common? Thus vegetables grow, as well as animals, but there is a material difference between theſe two kinds of growth; were they the ſame, both would either poſſeſs the ſame kind of life and ſenſe, or none of them would be ſenſible: the lower claſs of animals have the ſenſe of feeling or touch, as well as the higher claſs, but there muſt be a material difference between that very ſenſe in both: the higher claſs of animals poſſeſs, in ſome reſpect, reaſon; but I think there is an eſſential and cold, according to the ſurrounding atmoſphere it finds itſelf in. In great heat, which tends to deſtroy it, by increaſing the heat and motion of the internal and moſt material parts, it throws then the blood from the internal upon the external parts, and produces cold, by a diminution of motion; and when in a cold atmoſphere, it throws the blood internally, and increaſes there the motion, and produces heat, in order to defend thoſe material parts.

It is life that converts different ſubſtances of different properties into one and the ſame nature, as well when ſecreted by the different glands, as by the ſtomach and inteſtinal tube. Mr. HUNTER fed ſome dogs upon

---

difference between the reaſon of an animal and that of men; and ſo, if there are more ſenſible beings gradually from man to God, there is no doubt, that the laſt and the moſt compleat creature, is eſſentially different from the creator himſelf. The Hebrew reader may ſee the firſt chapter of Maimonedes' 8 philoſophical chapters.

upon vegetables, and others upon animal food only; the milk of both was analyzed by Dr. FORDYCE, who found them the ſame in their chymical properties. *(u)* Mr. HUNTER found alſo, the ſame of

---

(u) It is agreed by all phyſiologiſts, that foſſils are indigeſtible, ſo are likewiſe all eſſential oils: both retain their natural qualities, without ſuffering the leaſt change from the proceſs of digeſtion; in colours, which may owe their origin to the foſſil kingdom, we obſerve the ſame, as is evident, from the tinging of bones in animals fed upon madder, and from the colour of urine, after the exhibition of ſome medicines, as rhubarb, &c. The undeniable ſtriking effects of the balſamics, whoſe operation on the lungs is done after they have paſſed the proceſs of digeſtion in the inteſtinal tubes, and the ſurpriſing effects of the bark, opium, &c. are ſufficient to vindicate the reputation of medicine, which has ſuffered much by that new diſcovery of the powers of digeſtion. The experiments made by the ingenious Mr. HUNTER, however, are ſo convincing, that it requires great conſideration to determine in what manner medicines are able to operate. Some are of opinion, that the medicines exert their operation, whilſt in the ſtomach, before they are digeſted, by the ſympathy

of the cream in the *duodenum*, though the animals had been fed upon different ali-

ments;

---

pathy the ſtomach has with the whole ſyſtem; they make this opinion probable by many examples, where, as ſoon as the medicine enters the ſtomach, it ſhews its effect on ſome other parts, or glands of the ſyſtem; ſee Dr. ALSTON's Materia Medica, on the Cort. Peruv. and Dr. WHYTT on Opium. But the operations of aromatics and cathartics upon ſucking children, when exhibited to the nurſe, are undeniable proofs, that theſe medicines exert their effects, after they have entered into the blood. Perhaps all the operations of medicines conſiſt in their foſſil part; the ſurpriſing effects of iron, antimony, mercury, arſenic, ſulphur, lead, and all mineral acids and alcalis, are ſufficient to make this opinion probable: vegetable acids themſelves may be mineral acids, modified in the organization of the vegetable, which is more probable than to imagine a new acid originally in the vegetable. I am the more inclined to attribute the power of medicine to the foſſil part, ſince it is well known that huſks and bark are not digeſtible, and ſince even iron has been found in the blood; the component parts of the fibres are hitherto unknown, and may not they be of the foſſil kingdom? So that ſome foſſils and

minerals,

ments; he found even the ſame pure cream, when the animals were fed upon putrid meat, which is alſo a proceſs of life to reſiſt and convert putrefaction, evident in many of the lower claſs of animals, as maggots, &c. which live in and upon putrid ſubſtances; ſo do all vegetables, (ſee Dr. PRIESTLY on Air) by which Mr. HUNTER ſhews, that digeſtion is a power *ſui generis*, and not a kind of fermentation, ſince it converts putridity into a nouriſhing chyle; and on the contrary, whenever the power of digeſtion is weak, and the food undergoes, by the heat of the ſtomach, its own acid fermentation, then eructations take place. It is by the power of life, that living animals

---

minerals, when exhibited in diſeaſes of the ſolids, may perform their effect by incorporating themſelves into the fibres, repairing or renewing them. Were the mother, I mean the ſtudy of foſſology, as much courted by phyſicians, as her daughter, botany, many uſeful diſcoveries might perhaps be made: ſee alſo note *(i)*.

mals reſiſt digeſtion; worms, when in the inteſtinal tube, make their nidus as it were in it, inſtead of being digeſted or deſtroyed by its motion. It is by the power of life, that ſyſtems preſerve themſelves without exertion, as we find ſome animals lying dormant for a conſiderable time, during the winter, without dying; and by the ſame means, all vegetables preſerve their life, during the winter, elſe they could not revive again, as it is commonly expreſſed, in the ſummer, though all theſe properties may be produced mechanically, or rather chymically, in a manner not known to us, by the ſubtile ſtructure of the animal, and by its different motions and directions, when alive.

SECT. IV.

OF THE LIFE OF THE BLOOD.

IN the preceding ſection, we have explained that by the word life, is meant that property of a thing, by which it diſtinguiſhes itſelf from a dead part; we ſaid that a muſcle is called alive, while it has the power of contracting and dilating alternately, by any ſtimulus which a dead part has not; we may then ſay, that life conſiſts in motion, and death in reſt; and the reverſe, namely, the motion of a body is always according to the quantity of its life, and that again is always proportioned to the fluidity of the body; parts the moſt fluid are poſſeſſed of the greateſt motion, and the greateſt power of life: we find accordingly, that the fluids are in all living bodies, more than three parts of the whole body; a muſcle may be reduced to a very ſmall compaſs, when dried and exhauſted of its fluids, ſo may nerves, which ſhews that life conſiſts in fluidity and motion; the blood then, in which motion and fluidity are ſo apparent, and by which all aſſimulations are carried on, deſerves undoubtedly the name of life; the life of the blood is certainly different from the life of a ſyſtem, but has all the right to the life of a part, and may be called alive as much as a muſcle.

The blood ſhews the property of life, by preſerving itſelf in its fluidity, while confined in the veſſels; as when we tie a ligature on both ſides of an artery, ſo that the circulation ſhall be ſtopped, yet the blood between will remain fluid for three hours, nay even if we take out the blood veſſel, and tie it on both ſides, and freeze it, and thaw it again, the whole will be fluid; but if we take the blood out of the blood veſſel, it will coagulate in a minute or two; being then reſiſted by the heterogenous air, which endeavours to enter between its parts, and which it will reſiſt by its power of life, by contracting its parts together, as a muſcle does when pricked, and by that means it exhauſts its vital power, and coagulates, ſo that both theſe phænomena of the blood, when in and out of the veſſels, depend on its power of life; the one in preſerving itſelf, and the other in reſiſting powers which tend to deſtroy it.

The coagulation of the blood depending on its living principle, cannot be looked upon as repugnant to all chymical and mechanical proceſſes; in like manner, the contraction of a muſcle cannot be looked upon as ſuch, life being quite different from what we know of other chymical and mechanical powers. That coagulation depends on life, Mr. HUNTER ſhews by the time the blood takes, according to its ſtate, in coagulating, where he found, that the more it is poſſeſſed of that principle, the ſooner it coagulates. The coagulable lymph, as long as in the veſſels, circulates as a fluid, though when out of the veſſels, we find it in the form of a ſolid; when its power of life is gone, in which ſtate it cannot be fit for circulation, it would fill up the blood veſſels, if even we could ſuppoſe a ſpontaneous ſeparation from the thinner parts to take place; it is the life which keeps it fluid in the veſſels, and the life which coagulates it, when out of the veſſels, and which is always accompanied with motion; and it is clear, that parts, when become entirely motionleſs and ſolid, are ſaid to be dead; there can be no doubt then, of the blood being alive in the ſecond ſenſe of life.

Though we cannot reaſon from the circumſtances of the blood, or any fluid, after it is taken out of the veſſels, to its quality while in them, *(x)* yet I may ſay, we are able to determine, even after the blood is taken out of the veſſels, whether it poſſeſſes ſome of the ſtriking properties of life, and we are more juſtified to call it alive, when in the veſſels, after we find it poſſeſs properties of life, even when taken out of them.

If the power of coagulation is proved to be produced by the ſame conſent of parts, as the contraction of a muſcle, after it

---

(x) Many chymiſts, I imagine, miſtook, when they give us the real properties of the component parts of the different juices in the animal, by analyſing them, after they are taken out of the body: for the blood and all other juices, as ſoon as they are drawn out of their veſſels, and mixed with the external air and its acids, acquire directly quite other properties, as is evident, from the experiments made on Magneſia by Dr. BLACK and Dr. MAC BRIDE.

it is taken from the body; if we alſo perceive, as above mentioned, that the blood poſſeſſes the power of aſſimulation; if it alſo poſſeſſes that power of reacting and reſiſting all heterogenous bodies, that threaten to deſtroy the body, &c. I ſay, then the blood certainly is intitled to the name of life, as well as any other part of the body; it certainly is not poſſeſſed of all the properties, which are produced in ſyſtems, as a reſult of the whole, yet its exhibiting ſome properties of life, entitles it to be named alive.

Let us now examine the proofs of Mr. HUNTER upon this ſubject, and the objections made to them by Dr. HENDY, *(y)* for which, we ſhall give the reader the words of Mr. HUNTER, as related by Dr.

(y) In his Treatiſe, entitled an Eſſay on Glandular Secretion, and an Enquiry into the Opinion of Mr. HUNTER that the Blood is alive.

Dr. HENDY, and extract Dr. HENDY's objections as conciſely as poſſible.

Mr. HUNTER's firſt proof is, ſays Dr. HENDY, "becauſe it unites living parts "in ſome circumſtances, as certainly as "the recent juices of the branch of one "tree, unite with that of another:" to which Dr. HENDY objects, "That the "gardener does not depend on the juices, "but endeavours to oppoſe certain grafts "to ſimilar parts of the ſtocks; which he "applies together, as ſoon as the inciſions "are made, not that he wants the recent "juices, but becauſe the vegetating powers "are ſtill vigorous; and on this account, "he prefers a particular ſeaſon of the "year."

If life be taken in the ſenſe of growth, (ſect. 3.) it is certain, that the fluids or juices of the tree are the very ſame with that which Dr. HENDY calls the "*vigor of vegetation*;" for which

BOSTON MEDICAL LIBRARY
AUG 15 1927

reaſon, grafting never can be done in winter, when that life is not in action, is very weak; and for that very reaſon too, an old tree, where that juice or life is gone, can never be grafted; Dr. BLAGDEN, in the experiments and obſervations in a heated room, juſtly obſerves, "that the "ſudden melting of ſnow which falls "upon graſs, is owing to the vital power "which they poſſeſs in common with "animals, *(z)* ſince that of the adjoining "gravel walk, continue ſo many hours "unthawed;" he ſays farther, "moiſt "dead ſticks are often found frozen quite "hard, when, in the ſame garden, the "tender growing twigs are not at all affected; and many herbaceous vegetables, "of no great ſize, reſiſt every winter degrees of cold, which are found ſufficient "to freeze large bodies of water."

For

(z) And which is their internal motion and heat.

For a further explanation I ſhall give the reader Mr. HUNTER's words, in a paper read at the Royal Society, June 24, 1775, which are the following:

" To aſcertain whether vegetables could " be frozen, and afterwards retain all their " properties when thawed, or had the " ſame power of generating heat with " animals, I made ſeveral experiments. " Vegetable juices when ſqueezed out of " a green plant, ſuch as cabbage and ſpin- " nage, froze in a cold about 29°; and " between 29° and 30° thawed again, " which is about 4° above the point at " which the animal juices freeze and " thaw."

" I. I took a young growing bean, a- " bout three inches long in the ſtalk, " and put it into the leaden veſſel with " common water, and then immerſed the " whole into the cold mixture. The wa- " ter very ſoon froze all round it; how-

" ever the bean itſelf took up a longer " time in freezing than the ſame quantity of water would have done; yet it " did freeze, and was afterwards thawed, " and planted in the ground, but it ſoon " withered. The ſame experiment was " made upon the bulbous roots of tulips, " and with the ſame ſucceſs."

" II. A young Scotch fir, which had " two compleat ſhoots and a third growing, and which conſequently was in its " third year, was put into the cold mixture which was between 15° and 17°. " The laſt ſhoot froze with great difficulty, which appeared to be owing in " ſome meaſure to the repulſion between " the plant and the water. When thawed, " the young ſhoot was found flaccid. It " was planted; the firſt and ſecond ſhoot " we found retained life, while the third, " or growing ſhoot, withered."

" III. A young ſhoot of growing oats " with three leaves, had one of the leaves " put into the cold mixture at 22°, " and it ſoon was frozen. The roots were " next put in, but did not freeze; and " when put into the ground, the whole " grew, excepting the leaf which had " been frozen. The ſame experiment " was made upon the leaves and roots of " a young bean, and attended with the " ſame ſucceſs."

" IV. A leaf taken from a growing bean " was put into the cold mixture, and " frozen, and afterwards thawed, which " ſerved as a ſtandard. Another freſh " leaf was taken and bent in the middle " upon itſelf; a ſmall ſhallow leaden veſ- " ſel was put upon the top of the cold " mixture, and the two leaves put upon " its bottom; but one half of each leaf " was not allowed to touch the veſſel by " the bend; the cold mixture was be- " tween 17° and 15°, and the atmoſphere

"22°. The ſurfaces of the two leaves
"which were in contact with the lead
"were ſoon frozen in both; but thoſe
"ſurfaces which roſe at right angles,
"and were therefore only in contact with
"the cold atmoſphere, did not freeze in
"equal times; the one that had gone
"through this proceſs before, froze much
"ſooner than the freſh one. The above
"experiment was repeated when the cold
"mixture was at 25°, 24°, and the atmoſphere
"nearly the ſame, and with the
"ſame ſucceſs; only the leaves were longer
"in freezing, eſpecially the freſh
"leaf."

"V. The vegetable juices above mentioned
"being frozen in the leaden veſſel,
"the cold mixture at 28°, and the
"atmoſphere the ſame, a growing fir-ſhoot
"was laid upon the ſurface, alſo
"a bean-leaf; and upon remaining there
"ſome minutes, they were found to have

“ thawed the ſurface on which they lay.
“ This I thought might ariſe from the
“ greater warmth of theſe ſubſtances at
“ the time of application; but by moving
“ the fir-ſhoot to another part, we had
“ the ſame effect produced.”

“ VI. A freſh leaf of a bean was ex-
“ actly weighed; it was then put into
“ the cold atmoſphere and frozen. In
“ this ſtate it was put back into the ſame
“ ſcale, and allowed to thaw. No altera-
“ tion in the weight was produced.”

“ From the foregoing experiments it
“ appears; firſt, that plants when in a
“ ſtate of actual vegetation, or even in
“ ſuch a ſtate as to be capable of vege-
“ tating under certain circumſtances, muſt
“ be deprived of their principle of vege-
“ tation before they can be frozen. Se-
“ condly, Vegetables have a power with-
“ in themſelves of producing or genera-
“ ting heat; but not always in propor-

" tion to the diminution of heat by appli-
" cation of cold, ſo as to retain at all
" times an uniform degree of heat: for
" the internal temperature of vegetables
" is ſuſceptible of variations to a much
" greater extent indeed than that of the
" more imperfect animals; but ſtill with-
" in certain limits. Beyond theſe limits
" the principle of vegetable, as of animal
" life, reſiſts any further change. Thirdly,
" the heat of vegetables varies, according
" to the temperature of the medium in
" which they are, which we diſcover by
" varying that temperature, and obſerv-
" ing the heat of the vegetable. Fourth-
" ly, the expence of the vegetating powers
" in this caſe is proportioned to the ne-
" ceſſity, and the whole vegetable powers
" may be exhauſted in this way. Fifthly,
" this power is moſt probably in propor-
" tion to the perfection of the plant, the
" natural heat proper to each ſpecies, and
" the age of each individual. It may alſo
" perhaps depend, in ſome degree, on o-

“ ther circumſtances not hitherto obſerv-
“ ed: for in experiment II. the old ſhoot
“ did not looſe its powers, while that
“ which was young or growing did; and
“ in experiment III. and IV. we found,
“ that the young growing ſhoot of the
“ fir was with great difficulty frozen at
“ 10°, while a bean-leaf was eaſily frozen
“ at 22°: and in experiment V. the young
“ ſhoot of the fir thawed the ice at 28°,
“ much faſter than the leaf of the bean.
“ Sixthly, it is probably, by means of
“ this principle, that vegetables are adapt-
“ ed to different climates. Seventhly, that
“ ſuſpenſion of the functions of vegeta-
“ ble life, which takes place during the
“ winter ſeaſon, is probably owing to their
“ being ſuſceptible of ſuch a great vari-
“ ation of internal temperature. Eighthly,
“ the roots of vegetables are capable of
“ reſiſting cold more than the ſtem or
“ leaf; therefore, though the ſtem be
“ killed by cold, the root may be pre-
“ ſerved, as daily experience evinces. The

“ texture of vegetables alters very much
“ by the loſs of life, eſpecially thoſe which
“ are watery and young; from being britle and criſp they become tough and
“ flexible. The leaf of a bean when in
“ full health is thick and maſſy, repels
“ water as if greaſy, and will often break
“ before it is conſiderably bent; but if
“ it is killed ſlowly by cold, it will loſe
“ all theſe properties, becoming then pliable and flaccid; deprived of its power
“ of repelling water, it is eaſily made wet,
“ and appears like boiled greens. If killed quickly, by being frozen immediately, it will remain in the ſame ſtate
“ as when alive; but upon thawing, will
“ immediately loſe all its former texture.
“ This is ſo remarkable, that it would
“ induce one to believe, that it loſt conſiderably of its ſubſtance; but from experiment VI. it is evident that it does
“ not. The ſame thing happens to a plant

“ when killed by electricity *(aa)*. If a “ growing juicy plant receives a ſtroke of “ electricity ſufficient to kill it, its leaves “ droop, and the whole becomes flexi- “ ble.”

All which proves that life and the vegetating powers are one and the ſame thing. I do not know what Dr. HENDY means, by “ oppoſing certain grafts to ſimilar “ parts,” unleſs he thinks that the pores of the piece grafted and thoſe of the tree may be ſo fitted together, that there might be a free paſſage and circulation for the juices to enter from all ſides of the tree to the piece grafted, ſo as to unite it, and to perform in that piece the action of life, tho’ I do not believe it poſſible, to fit the pores of the piece to thoſe of the tree.

(aa) To kill a whole plant by electricity, it is neceſſary to apply the conductor, or give a ſhock to every projecting part; for any part that is out of the line of direction will ſtill retain life.

Nature grafts, as it were, in the ſame manner the animal body, by the proceſs of granulation and cicatrization, which agree in all circumſtances with grafting; cold and old age are in both caſes unfavourable *(bb)*.

The ſecond proof of Mr. HUNTER, is "were either of theſe fluids to be conſi-"dered as extraneous or dead matter, "they would act as ſtimuli, and no u-"nion would take place, either in the "vegetable or animal kingdom." Here I plainly find that Mr. HUNTER agrees with me in not confining life to the blood alone, but in extending it to all fluids in general,

---

(bb) I cannot help making a philoſophical remark, namely, that nature always combines, as it were, with every evil a ſomething which prevents the very proceſs of the evil itſelf. Thus in young perſons where there is danger of general inflammation by the vigour of the blood, that very vigour is the cauſe of producing kind ſupperation and granulation; and in old age, when granulation is not favourable, it is commonly the very ſame weakneſs which prevents general inflammation.

general, and there is no doubt that all extraneous matter acts as ſtimuli; the blood itſelf, as ſoon as it cannot be as an homogenous principle, conſtantly changed, and aſſimulated, (ſect. 2.) ſtimulates the parts it runs to, as is plain from the circumſtances of inflammation, where the ſmall veſſels are contracted, and conſtantly ſtimulated by the flow of blood. In acute rheumatiſm that kind of ſtimulation is ſo ſtrong as to cauſe (according to my opinion) the conſtant metaſtaſis.

The teſticle of the cock which Mr. HUNTER introduced into the belly of a living hen, and found it injected by injecting the liver of the hen, and which he alledges as a proof of his opinion, is objected to by Dr. HENDY, namely, "that ſince, according to Mr. HUNTER's "idea, any dead matter produces a kind "of proceſs, to throw off the dead from "the living part; why did not the teſticle of the cock cauſe that proceſs to

"begin?

"begin?" But let me aſk Dr. HENDY, why does not the grafted piece deſtroy the ſtock; the reaſon is plain, namely, that the action of the ſtock and its juices overcomes the ſtimulus of the grafted piece, and gives it life as it were, in uniting it; in the ſame manner as the recent teſticle becomes an homogenous part of the hen, and unites with it, inſtead of acting upon it as a ſtimulus; but that great maſs of fluids in the animal body, were it to be merely paſſive and extraneous, and to ſerve only to keep the ſides of the veſſels diſtended, it certainly would deſtroy the ſyſtem by its ſtimulation, inſtead of which, it is now the very principle which guards it from being deſtroyed by external ſtimuli (ſect. 3.).

Mr. HUNTER's third proof is, "that "the blood becomes vaſcular, ſo that after "amputation the coagulum may be in-"jected by injecting the extremities of "the arteries," which phænomenon Dr. HENDY

HENDY endeavours to account for, by the elongation of the arteries, and which he thinks is alſo the cauſe of union in inflammation, commonly called, *healing by the firſt intention,* as we obſerve in the adheſions of an inflamed pleura; and in the caſe of DU HAMEL, who placed the ſpurs of a cock upon the comb when inflamed, and grew there uniting with the comb; Dr. HENDY therefore ſays, "that "it was not the coagulum, but the elongated arteries which run thro' the coagulum, which was injected." I believe all theſe facts will be a ſtrong proof to confirm Mr. HUNTER's idea; becauſe it is not enough to know that an elongation takes place (if even we ſhould ſuppoſe it) but we ought to know alſo in what manner and by what means it takes place; and is it not to be ſuppoſed, that elongation is occaſioned by the converſion of fluids into ſolids, which is done by the fluids in general uniting the ſides of the veſſels, and which Mr. HUNTER properly calls, the *adheſive inflammation?* Du Hamel's caſe may be explained in the ſame manner. We may farther ſay, that the fluids ſurrounding the fibres are the cauſe of that proceſs from all its circumſtances. Inflammations of the extremities do not heal ſo kindly, becauſe not ſurrounded ſo much with living fluids; in young men, when the conſtant converſion of ſolids and fluids is in its greateſt vigor, the cauſe of growth, kind ſuppuration and granulation take oftner place than in old age, and no body ever doubted that old age is combined with a deprivation of the fluids, and youth with a repletion of them; and beſides all theſe, I think, in amputation, no elongation of the arteries takes place, and the concluſion of Dr. Hendy, even according to his idea of union in inflammation, I think, is a little too quick, ſince that elongation is only in conſequence of the ſurrounding ſound and living parts, whereas by amputation, when the ſtump is expoſed to extraneous bodies, a contraction, not an elongation, takes place, as we really find, that all the little branches of the arteries in the ſtump ſhrink, inſtead of being elongated; and it is always the nature of living parts, when expoſed to extraneous bodies, to contract themſelves, in order to prevent and reſiſt the detrimental effects of the extraneous bodies. It is by the ſame law, that the blood coagulates. (ſect. 2.)

The ſhrinking of the arteries in amputation leads Dr. HUNTER, in his lectures, to blame the method of ſecuring each little branch of the arteries in amputation, to prevent an hemorrhage; he ſays, it is torturing the patient uſeleſsly, becauſe thoſe little branches commonly ſhrink of their own accord; I believe therefore, that it was the coagula, and not the branches of the arteries, which were injected.

Dr. HENDY goes on further with his objection, " the blood in its coagulated "ſtate, cannot poſſibly be ſaid to poſſeſs "life." Mr. HUNTER agrees to view the blood as a fluid, as Mr. HUNTER expreſſes his words, "that in the nature "of things, there is not a more intimate "connection between life and ſolid, than "between life and fluid, by coagulation "the blood looſes its fluidity and becomes "ſolid; he there ſays, that ſince life is, "according to Mr. HUNTER himſelf, that "property of irratability, by the action "of any ſtimuli, the coagulum has not "ſuch irratability, and therefore cannot "be alive."

Though it is certain, that *a priori*, there is no more intimate connection between fluid and life, than between ſolid and life, yet I think, *a poſteriori*, we never find life exiſt without the union of the three principles, ſolid, fluid, and vapor. (ſect. 1.) The blood, in a coagulated ſtate, certainly does not poſſeſs life, but that principle of coagulation itſelf

ſelf is owing to its irritability, and is a principle of life, the ſame as the irritation and contraction of a muſcle is called its living principle, though when remaining contracted, the muſcle is ſaid to be dead.

The fourth argument of Mr. HUNTER is very convincing; his words are, " blood " taken from the arm, in the moſt intenſe " cold which the human body can bear, " raiſes the thermometer to the ſame " height, as blood taken in the moſt " ſultry heat." It is certain, that the peculiar property of life, to reſiſt both cold and heat, is done by the different circulation of the fluids, (ſect. 3.) and therefore cold and heat will not change the degree of warmth in the blood; but were this property to conſiſt in the fibres only, and the blood be merely paſſive, then certainly, the moment the blood is drawn out of the fibres, it would be cold or warm, according to the degree of the atmoſphere, as all other dead bodies. The objection of Dr. HENDY, that it cools in leſs than two hours, is I think very futile; Mr. HUNTER never intended to ſay, that blood is ſo much alive, as never to die; it is ſufficient, that after it has been drawn for ſome time out of the veſſels, and from the animal ſyſtem, it retains the moſt ſtriking properties of life, ſo as to raiſe the thermometer to the ſame height, in different degrees of heat: Dr. HENDY agrees to call a muſcle alive, when ſeparated from the animal, as long as it is irritable, and contracts itſelf alternately; though he certainly often ſaw the muſcle reſt in leſs than two hours time, and in my opinion, the life or irritation of the muſcle itſelf conſiſts in its fluidity, connected with its fibres; a dry muſcle never is irritable. *(cc)*

(cc) That is very probable, if we conſider that

The fifth argument is, "blood is ca-"pable of being acted upon by a ſtimulus, "for it coagulates on expoſure, as cer-"tainly as the cavity of the thorax or "abdomen inflames from the ſame cauſe." Dr. HENDY ſeems here to laugh at this argument, as being very ridiculous, and ſays, "we may as well ſay a jelly is alive, "becauſe it coagulates by expoſure to air:" but I think there is a difference between the coagulation of a jelly, and that of the blood, becauſe a jelly will coagulate, if even in a veſſel; but the blood, as long as in the veſſels, will reſiſt cold; the coagulation of a jelly is a mere paſſive body to the cold, whereas that of the blood is done by its living principle of contraction, as the inflammation of the thorax or ab-

---

muſcles of animals in full health, abounding with proper fluids, when cut acroſs, ſhew a more remarkable retraction towards each extremity, than the muſcles of animals in a languiſhing ſtate and exhauſted of their fluids.

domen is done by their living principles of contraction and reſiſting the cold; all jellies will coagulate alike, and in one given time, when in the ſame degree of cold, and evaporate to the ſame conſiſtence; whereas, blood will differ in the time of coagulation, in proportion to the difference of its being ſound or diſeaſed, that is, according to its principle of life, as appears from the following argument of Mr. HUNTER, which is the ſixth; "The more it is alive, (i. e. the more "the animal is in health) the ſooner it "coagulates on expoſure, and the more "it has loſt of its living principle, as in "caſe of violent inflammation, the leſs it "is ſenſible to the ſtimulus produced from "its being expoſed, and the later it coa-"gulates." Upon which Dr. HENDY remarks, "It is a very curious kind of life, "that the more it is alive the ſooner it "dies, whereas in other kinds of life, we "find the contrary." To which I anſwer, that that very curious and comical kind of life is to be found in all nature, and agrees with the laws of reaction, (ſect. 2.) ſo that certainly any ſubſtance dies the ſooner, under the ſame circumſtances, the more it is alive, that is, the ſtronger it reacts: a thin reed will ſuffer the blaſt of the moſt violent guſt of wind, and not be broken; whereas, the great oak tree, by the ſame force, will be cruſhed to pieces; nobody ever thought that this is owing to the reed's being ſtronger than the oak, but becauſe one yields to the action, and the other reacts; vegetables, and many of the lower claſs of animals, will continue alive in a dormant ſtate during the winter without nouriſhment, (ſect. 3.) whereas the higher claſs of animals will ſoon die, under the ſame circumſtance; many diſeaſes will ſeize a ſtrong perſon, whereas the weak will eſcape them, if even expoſed to the ſame cauſes; expoſure to cold will be more hurtful to a ſanguine, than to a melancholic or hypochondriac temper, ſo that weakneſs is not always a prediſponent cauſe to diſeaſes, or to be affected by ſtimuli, as Dr. HENDY thinks, but on the contrary; Dr. FORDYCE, in his lectures for the ſame reaſon, makes a difference between irritability and weakneſs; (ſect. 2.) after a part has been for a long time diſeaſed, it certainly looſes that power of reaction, though it is very irritable, ſo as to be deſtroyed by any ſtimuli. It is by this very principle, that the blood, in inflamed caſes, does not react, the ſtimulus therefore is not ſo great, as that it ſhould coagulate, whereas in a ſound ſtate, it reacts with the greateſt force, ſo as to exhauſt its life, and coagulates directly.

Mr. HUNTER does not mean, that the blood never coagulates but by ſtimuli; he hardly would commit ſuch a groſs miſtake, though the infuſing of blood in the brain, which Dr. HENDY thought to be a great proof of the blood's coagulating without a ſtimulus, might be owing to the ſtimuli of the meninges; but death itſelf, in which the blood coagulates, is not done by ſtimuli, but by a natural ceſſation of life. *(dd)* Mr. HUNTER therefore can only mean, that as long as the blood is alive, it coagulates by ſtimuli alſo, and the more it

---

(dd) Mr. HUNTER, thinks that even the coagulation in death is produced by a ſtimulus; ſince he has obſerved, that whenever an animal dies ſuddenly, as he often kill'd animals by electricity, ſo that the living principles are deſtroyed at once, that then all the muſcles are in a relaxed ſtate, and the blood is not coagulated; whereas when the animal dies a natural death, or in a diſeaſe, contraction and coagulation take place gradually, by the living powers reacting the ſtimulus, namely death; he has made the ſame obſervation on a man, who lately died ſuddenly in a paſſion, that his muſcles were relaxed, and his blood not coagulated; which proves alſo, that the coagulation of the blood, and the contraction of the muſcles, depend on one and the ſame principle of life, as I have remarked throughout the whole; but in the experiments on the blood, made by Mr. HEWSON, it ſeems, that the mere ceſſation of motion is able to coagulate the blood. See his experimental Inquiry, &c. page 21.

it is alive, the more it reſiſts the ſtimuli, and the ſooner it exhauſts its power of life by this great exertion, and being overcome by the ſtimuli it ſooner coagulates, not that there are no other means of coagulation beſides ſtimuli.

The ſeventh argument is very convincing; ſays Mr. HUNTER, " the " blood preſerves life in different parts " of the body; when the nerves going to " a part are tied or cut, the part be" comes paralitic, and loſes all power of " motion, but it does not mortify. If " the artery be cut, the part dies, and a " mortification enſues," to which Dr. HENDY objects, that this will prove no more than that there is nouriſhment chiefly conveyed by the arteries, and not by the nerves, and he thinks " that the a" naſtomoſing branches of the nerves " continue the circulation of the fluids, " and which depend upon the action

“ of the ſolids produced by the nervous in-“ fluence.” The difference which Dr. Hendy makes between nouriſhment and life, I have confuted already in the firſt argument, becauſe nouriſhment is performed by a conſtant converſion of the three principles in which life conſiſts, or which is at leaſt never ſeparable from life; and concerning his opinion of anaſtomoſing branches of nerves, it may be rejected by the following arguments:

1ſt. Were there any anaſtomoſing branches, motion would continue in the ſame manner as the anatomoſing branches of the blood veſſels keep up the circulation, ſo as to prevent putrefaction, tho’ the large veſſels are tied, as is ſeen by the application of a *turnicate* upon the baſilick vein, and artery, where the circulation of the hand and wriſt is kept up by the anaſtomoſing branches.

2dly. If the principle nerve is cut off, no anaſtomoſation is to be thought of. (Though it might be ſaid that the nerves which are in the muſcular coat of the blood veſſels, prevent putrefaction.) As ſoon as the communication of the principle nerve is taken from the common ſenſorium or encephalen, all their branches are dead alſo, and have no more communication with the principles of ſenſation.

3dly. There is a very material difference between nerves and blood veſſels; any ſet of blood veſſels will ſerve in any part of the ſyſtem to keep up circulation and reſiſt putrefaction, whereas by nerves we obſerve, that each ſet has its particular office, which another cannot ſupply: the nerves running to the eyes, are fit for viſion, as thoſe to the ear for ſound only, and ſo with the other ſenſes, they have each different feelings;

all which muſt be accounted for by the different reaction of the different nerves (ſect. 2.), according to their nature. Some phyſiologiſts carry this point ſo far as to attribute certain ſtimuli to certain nerves; thus they ſay jalap is a ſpecific ſtimulus to the inteſtines; *ipecacuanha*, to the ſtomach; *cantharides*, to the neck of the bladder, &c. which opinion if clearly inveſtigated, ſhews the real difference between the different ſets of nerves, ſo that anaſtomozation cannot be of the ſame ſervice by nerves, as it is in blood veſſels.

The concluding and laſt objection of Dr. HENDY is, "that blood cannot perform any action of life when taken out of the animal, nor is it organized." Dr. HENDY calls a muſcle alive as long as it is acted by any ſtimuli, though he hardly can mean that a muſcle can perform the action of life, but this objection

tion is entirely owing to his confounding volition with life, which has already been diſtinguiſhed (ſect. 3.). It is true that in ſyſtems organization and life are inſeparable, but were there no life in the component parts of this organization, it could not reſult from their mere compoſition. See note *(n)*.

SECT. V.

OF PHLEBOTOMY.

IT has been commonly obſerved, that the repetition of bleeding produces a plethora, hence a late author would infer, that the frequent uſe of V. S. will occaſion all the diſeaſes, which are the effects of a real plethora, as *convulſions, ſt. vitus dance, epilepſy, &c.* Whereas I ſhould think, that there is a great difference between a real plethora, and the ſudden repletion of the veſſels in repeated V. S.

It is true that after bleeding, the proceſs of nutrition is very quick, ſo that the loſs of blood is ſoon reſtored, which proceſs is properly referred to the *vires naturæ medicatrices*; but is it conſiſtent with reaſon, that fluids ſo ſuddenly ſecreted, as is in the caſe of frequent V. S. ſhould be of the ſame quality and conſiſtence, with fluids ſecreted in a natural ſtate? A repletion of that kind, might be called a fulneſs of the veſſels with unconcocted fluids, which will produce a ſet of diſeaſes, quite different from thoſe which are the conſequence of a plethora with real blood: a general relaxation will be produced from the rarefaction of the blood, and the preternatural actions of the fibres, in ſecreting it continually, ſo that the patient will ſink under debility.

If it be true, that the fibres are continually renewed by the blood, (ſect. 1.) then their debility muſt of courſe increaſe, when the blood is, by repeated V. S. attenuated; the blood in a rarefied ſtate, certainly does not ſtimulate the fibres in the ſame manner, as when in a denſe ſtate, by which means the veſſels are not excited to contraction, and conſequently the blood is not preſſed enough to acquire its proper conſiſtence.

The rarefaction of the blood, and the weakneſs of the fibres, after repeated *(ee)* V. S. is evident from the ſtate of ſuch patients who uſe frequent V. S. their appetite is diminiſhed inſtead of being increaſed, and their powers of digeſtion are weaken'd.

Mr. HEWSON has plainly ſhewn, by his experiments. *(ff)* " that even tempo-" rary exertion of ſtrength in the blood " veſſels, might alter the properties of the " lymph:" he thought it very difficult to conceive " how the blood veſſels ſhould

---

(ee) The thinneſs of the coagulable lymph, after repeated V. S. may eaſily be found out, by weighing the coagulable lymph, after the different operations, in different cups, where the laſt will always be found the lighteſt.

(ff) In his Treatiſe on the Blood, page 129.

“ do ſo,” which may be accounted for thus; the blood poſſeſſes life, and re-acts with this power, to the preſſure of the veſſels in circulation, by which it contracts and dilates itſelf alternately, in its reaction as well as the veſſels in their action, (ſect. 2.) and acquires by this motion its requiſite property; but in a debilitated ſtate of the veſſels, the reaction of the blood is ſtronger than the preſſure of the veſſels, and conſequently the blood begins, by its power of life, to coagulate, and the lymph is thicker than it is in a ſound ſtate of the veſſels, where it is rarefied by their preſſure.

The blood and fluids, which are now ill-conditioned, will by their connection with the ſolids, produce an encreaſed weakneſs, and a diminiſhed elaſticity in them, and ſo on; ſo that the ſolids and fluids, in a diſeaſed ſtate, prey upon and deſtroy each other alternately, as they in a ſound ſtate, nouriſh and repair each other.

Again the veſſels poſſeſs a certain power, with which they contract themſelves continually to a certain point; by a derivation of blood, the veſſels, which muſt be always full, are obliged to contract within their natural dimenſion; the force then with which they contract each of their fibres to preſs upon the blood, is now diminiſhed, great ſtrength being waſted by their preternatural contraction, in order to leſſen their diameters, and conſequently their preſſure on the blood is not ſo great as uſual: hence the alteration of the blood's property, from the ſtate of the blood veſſels.

If the obſervations made by all former phyſicians, that the ſtate of the blood is much altered, according to the nature of the aliments we make uſe of, be proved by facts; *(gg)* and yet other experiments ſhew,

---

(gg) Which might eaſily be proved, by feeding

ſhew, (ſect. 3.) that all aliments are changed into one and the ſame chyle, we then certainly muſt account for thoſe alterations in the blood, by the ſtate of the ſolids, and by the nature of the aliments and their effects, before they are digeſted; to their being eaſy or difficult of digeſtion. Aliments which require a great exertion of the digeſtive powers, will weaken the ſtomach, and conſequently the ſolids in general; ſo that the fluids will be leſs preſſed upon than is requiſite, and by that means, be reduced into a vitiated ſtate: aliments which are too ſuſceptible of change, will ferment before they are digeſted, and afford little nouriſhment to the ſyſtem; they will alſo weaken the ſtomach,

---

ſome animals upon ſuch food, as is ſaid to increaſe the globulous part, and others upon food, which has been ſuppoſed to increaſe the quantity of the ſerum, others again upon food, which is ſaid to make the juices acrid, &c. and then bleed theſe animals, and analyze their blood, which experiments will be attended with little torture to the animals.

ſtomach, by the different eructations they occaſion; ſo that according to the ſtate of the ſtomach, in the time or manner of digeſtion, and according to the aliments and their effects, the ſolids will either be weaken'd or ſtrengthen'd, and the fluids thereby affected: thus then will the fluids always either be pure or nouriſhing, and have their due conſiſtence, or acrid and vitiated, in proportion to the ſtate of the ſolids.

The ſizy or buffy cruſt has been always conſidered as the criterion of repeating V. S. in inflammatory caſes; but this criterion may often miſlead us; becauſe, though it be undeniable, that this appearance is the characteriſtic ſign of inflammation (the coagulable lymph being rarefied by the heat of the body, and its increaſed actions, ſwims at the top by its levity) *(hh)* yet whether the cruſt indicates

---

(hh) "The inflammatory cruſt or ſize is not a new formed

cates repetition of V.S. till its diſappearance, I doubt very much. I have ſeen that

---

formed ſubſtance, but is merely the coagulable lymph, ſeparated from the reſt of the blood. This ſeparation ſeems to be occaſioned by the lymph's being attenuated, by which means the red particles ſoon ſettle to the bottom, and leave the ſurface of the blood tranſparent; and this tranſparent part being a mixture of the coagulable lymph and the ſerum, the former coagulates on its ſurface where, in contact with the Air, and the diſpoſition to coagulate being likewiſe diminiſhed, the blood remains a long time fluid, and thereby gives time for the pellicle formed on its ſurface to attract the reſt of the lymph, and to collect it at the top, leaving the bottom of the cake proportionable ſofter. The ſize therefore is thicker, and denſer, in proportion as the lymph is thinned, and is leſs diſpoſed to concrete. But it is not a certain ſign of inflammation, and does not appear to be the cauſe of that diſeaſe, but only its effect:" HEWSON's Experimental Enquiry, &c. page 124. I agree with Mr. HEWSON, in the fact of attenuation of coagulable lymph; but that very attenuation is a ſign and effect of the increaſed action of the veſſels, which is the characteriſtic ſign of an inflammation. Mr. HEWSON ſays in the fore-mentioned Treatiſe, page 33. "as the blood is coagulable by heat, and as the heat of the that practice perſiſted in, at the expence of the patient's life.

If we conſult reaſon, we ſhall find, that the ſizy cruſt is not the diſeaſe itſelf, but its ſymptom, pointing out the increaſed action and heat of the body, which rarefies the blood; yet at the ſame time, there are many particles of blood ſtill in the ſyſtem, which are not rarefied, (otherwiſe death

---

the animal is increaſed in fever, it has been ſuppoſed, that the blood might be coagulated by the animal heat, even whilſt it is circulating in the veſſels; but there is little foundation for ſuch an opinion, ſince the animal heat is naturally only 98° or 100°, and in the moſt ardent fever, is not raiſed above 120°." Certain it is, that the weaker the blood, the later it coagulates when out of the veſſels (ſee ſect. 4.); but when in the veſſels, it may begin to coagulate with a leſs degree of heat, upon quite other principles, I mean, when the veſſels preſs upon it preternaturally, as is the caſe in inflammation, it begins then to reſiſt by its power of life, and coagulates inſenſibly, though ſuch proceſs is continually hinder'd, as long as it is in the veſſels, by their continual preſſure.

death would enſue) and which, in many caſes, poſſeſs ſtrength enough to reſiſt and overcome the diſeaſe, in different ways, either by converting the very vitiated fluids into nutritious, or by expelling them through the different emunctories; but by repeated V. S. there is every time a great quantity of ſound blood drawn out of the body, by which means we deprive nature of all its natural ſtrength, with which it ſtruggles with the diſeaſe; the ſizy cruſt therefore ſhould only ſerve to ſhew us the ſtate of the inflammation, ſo that we may uſe antiphlogiſtics, not that we ſhould repeat bleeding, and exhauſt nature of all its ſtrength and life. When bleeding is repeated on the ſame criterion in women with child, we run the riſque of looſing two lives, that of the mother and the fœtus *(ii)*; hence I ſhould conclude, that whenever bleeding is not neceſſary,

---

(ii) *Γυναικῃ ἐν γαςρί εχέσῃ υπό τινος των ὀξέων νεσηματων ληφθῆναι, θανάσιμον.* Hippoc. ſect. 5. Aph. XXXI.

ceſſary, as an immediate preſervative of life, we ſhould uſe it very ſparingly, and even then, when the caſe does not require an immediate large evacuation, we ſhould rather bleed a little, and repeat it, than draw off a great quantity of blood at once *(kk)*; and that we ſhould always obſerve the ſtate of the blood, the time of its coagulating, the denſity and weight of the lymph; and laſtly, whether it abounds with red globules; becauſe in the following ſection, I ſhall conjecture, that many diſeaſes take their origin from the abundance of that part of the blood, as others from its want.

(kk) Fere etiam iſta medicina, ubi neceſſaria eſt, in biduum dividenda eſt. Satius eſt enim, primum levare ægrum, deinde pepurgare, quam ſimul omni vi effuſa fortaſſe præcipitare. Celſ. de Med. lib. 2. chap. 10. See alſo Hip. Aph. ſect. I. XXIII. and Celſ. Aph. Sect. 10, 23, to 29.

SECT. VI.

OF THE RED GLOBULES.

THAT the red globules of the blood abound with more oily ſubſtances, than the ſerum and lymph, is evident, from their being more inflamable than the lymph and ſerum, and from their yielding large proportions of empyreumatic oil, when analyzed; but this will not prove, that oily particles are the only ſubſtances out of which the red globules conſiſt, nay it ſeems more probable, that they are a mixture of oily and earthy particles, by which means their ſpecific gravity is more than that of the ſerum and lymph; the earthy may ſerve as a nucleus to the oily particles, round which they adhere, and which gives them their globulous form: the earth of the bones, which abound alſo with oil, may probably take its origin from the red globules, as the fibrous part of the animal, may take its origin from the lymph and ſerum (ſect. 1.)

It is well known, that the beginning of oſſification is produced, by ſome parts of the blood ruſhing continually between the fibres of the fœtus, called cartilages and membranes, and depoſiting their boney matter there in different lamina, which is evident from the inflammation in thoſe parts where oſſification appears *(ll)*; it is therefore

---

(ll) Anatomiſts do not expreſs themſelves preciſely, when they ſay, " that blood veſſels run into the bones," ſince ſtrictly ſpeaking, the bones run between the blood veſſels; the fibres in general being prior in formation to the bones, and the latter are formed between the former; namely, by the calcarious earth which is in the blood, and which earth is continually propelled by the motion of all the fibres together, ſo as to confine

fore very probable, that the red globules are the very particles which ſhoot between the fibres, and form bones; that they are a mixture of mucilage or oil, and calcarious earth, ſome have more mucilaginous ſubſtance than calcarious earth, and others more earthy than oily parts; the former conſtitute the ſoft, and the latter the hard bones; where the latter ſhoot, they

---

confine it between them, and form bones; and it is very probable, that the different convolutions of the fibres, which run between the bones, give the bones their laminated and reticular, or net-like form. In the ſame manner, we may perhaps be miſtaken, when we ſay, "that the notches of ſome bones ariſe from the motion and friction of the muſcles upon them;" whereas it may be rather ſaid, that the muſcles being prior in appearance to bones, therefore the bony particles are lodged in their very firſt formation, by the direction and ſituation of the muſcles, in ſuch a manner as to aſſume the appearance of notches; becauſe, had the bone, in its original formation been without the notch, the rubbing of the muſcle upon it, would have rather ſerved to deſtroy itſelf, than to alter the figure of the bone.

they diſtend by their hardneſs the fibres, between which they run, and give them the appearance of membranes; whereas thoſe fibres between which the former ſhoot, remain in their cartilaginous ſtate.

Dr. NESBIT's doctrine of the two kinds of oſſification, between cartilages and membranes is generally accepted, without aſſigning a reaſon, why thoſe, which ſhoot between membranes, ſhould be hard, and others, which ſhoot between cartilages, ſoft bones; whereas, if we pervert the poſition, as I do, and make Dr. NESBIT's cauſe the effect, we may rationally account for the difference of membranes and cartilages, ſince it ſeems, that originally theſe membranes were cartilages. Certain it is, that many membranes are in the fœtus originally, as the *dura* and *pia mater*, the membranes of the eyes, the *pleura*, *mediaſtinum*, *pericardium*, the external coats of the glands, and all mucous membranes, &c. but that may not be the caſe of thoſe membranes, between which the bones ſhoot, as the contrary ſuppoſition is very rational.

I further ſuppoſe, that oſſification goes on continually, even after growth, though inſenſible, and that always ſome new boney particles are formed by calcarious earth of the blood; whilſt others are waſted and thrown off, inſenſibly, in the ſame manner, as many phyſiologiſts juſtly maintain, that the fibrous parts of the animal undergoes a continual granulation.

Even in the univerſe, I believe, that the minerals, ſimilar to bones in animals, undergo the ſame continual change, though inſenſible (ſect. 1.), as well as the ſoft parts, earth, water and air —— *(mm)*.

And

(mm) Mr. Godfrey converted a conſiderable quantity of diſtilled water into a perfectly dry earth, and

Mr.

And thus I would explain the generation of gravel and calculi, as a fault in oſſification, ſo that the calcarious earth, inſtead of being impelled into the bones, is carried along with the chyle or blood, into ſome other cavities or glands, and lodged there, as in the kidneys, bladder, ductus, cholidochus, inteſtines, &c. If the aliments taken abound with calcarious ſubſtances, there will be more calcarious earth ſecreted and mixed with the blood, than the bones are able to abſorb; that earth, when it finds no nucleus, is ſometimes expelled along with the urine, in the form of gravel, and in the ſame manner it may be expelled from the other glands along with their ſecretions; whereas, when it finds a nucleus, it forms into a ſtone. Many circumſtances make this hypo-

---

Mr. Woulfe is, by his own experiments, perfectly ſatisfied of the fact. Dr. Priestley is able to convert a large quantity of earth into air; ſee his Philoſophical Empiriciſm, page 57.

hypotheſis probable; the animal ſmell, which calculi exhibit in their calcination, like that of bones; that perſons who are troubled with calculi, are found commonly to have oſſifications of arteries; that in gouty people, a concretion of earth is found between the bones, commonly call'd chalk; the ſoftening of bones, which is commonly concomitant with calculous complaints, and different oſſifications; the nature of calloufes in fractures, and granulation in ulcers *(nn)*; that in old age, different

---

(nn) The calluſſes of bones in fractures, and the nature of anchyloſes, ſeem to be a proof of the conſtant granulation even in bones. I cannot imagine, that that kind of oſſification is deſignedly produced in fractures, &c, as a new building, were there not a continual proceſs of oſſification, by the ſtated laws of the ſyſtem; Mr. HUNTER's obſervation on the different ſtate of bones in animals, after they have been fed upon madder, is a ſtrong evidence of this aſſertion; ſee his Treatiſe on the Teeth. Nor does it ſeem probable, that the extravaſation of the coagulable lymph in wounds, is occaſionally produced as a wiſe management

ferent oſſifications take place; (becauſe the boney matter, which otherwiſe would have been expelled into the bones, adheres on the ſides of the veſſels, when by age the power of motion is diminiſhed). All theſe circumſtances make it very probable, that calculi are generated by a fault in the oſſification, occaſioned either by the abun-

---

ment of the ſyſtem; but I rather believe, that it is a neceſſary conſequence of the continual circulation and motion of that part of the blood itſelf. The coagulable lymph, which circulates always as a fluid along with the other parts of the blood, conſequently, when there is an opening between the fibres, and it is expoſed to the air, coagulates and ſticks by its tenacity to their ſides, and combines them together. It ſeems repugnant to me to give the ſyſtem ſenſe, or to have the ſoul continually watching, ſo as always to produce ſomething new, whenever an accident happens; which is, only in other words, reviving the old doctrine of STAHL, who attributed all theſe merits to the ſoul, which, as he thought, is continually watching to ſuſtain and repair the body. Whereas we may account for all theſe phænomena, by the ſtated mechanical and chymical laws of the ſyſtem, aſſiſted by life.

dance of the calcarious earth, or by the weakneſs of the fibres, to impel it into the bones. It ſeems, that the excruciating pains in the gout are occaſioned by the little particles of earth, which lodge between the muſcular fibres, and ſtimulate them, and which particles, in a ſound ſtate, would have been impelled into the bone: gravelly calculi and gouty complaints are therefore concomitant diſeaſes, ſince they ariſe from one cauſe, namely, a fault in the conſtant granulation of bones; hence every thing which weakens or relaxes the ſolids, as intenſe thought, a ſedentary life, the exertion of paſſions, intoxication, &c. are the forerunners of all the above-mentioned diſorders *(oo)*.

The

(oo) Sometimes by a too great fulneſs the veſſels will be weakened, and the ſame diſorders will enſue, ſince hæmorrhides, the gravel, &c. are often concomitant complaints; and in which caſes, they commonly aggravate one another, by the connection the rectum has with the bladder, ſo that ſometimes real ſtrangury

The gout will be hereditary, becauſe the fibres are weak as it were, in their firſt make, I mean in the ſemen of the father.

When once a ſecretion has taken place in ſome particular part or cavity of the body, all homogenous parts will flow to that place, according to what we obſerve in nature in general, and which is very evident in the animal body, from iſſues, &c. hence, if ſome boney particles have found their way into ſome cavity, an influx of the ſame will continually take place, and the calculi will be increaſed.

That calculi do not aſſume the internal figure of bones, can be no objection to their being of the ſame nature; becauſe they do not ſhoot between fibres as bones do,

---

ſtrangury is occaſioned by the internal hæmorrhides, when the patient attributes it to its gravelly complaint: an eminent phyſician aſſured me of the fact, after I told him my thoughts upon the ſubject *a priori.*

do, which fibres confine them to certain directions as before-mentioned (note *ll)*; but calculi being left, as it were, to themſelves, they adhere together, according to the laws of attraction or impulſe, in almoſt a round figure, unleſs they have ſome heterogenous body to their baſis, as hair, &c. when they take on the form of their bones by adhering round it.

If theſe conjectures could be proved by facts, then certainly it would be of the greateſt conſequence, to pay particular attention to the nature and quantity of the red globules in V. S. in order to prevent thoſe diſeaſes, which may ariſe from either their want *(pp)* or abundance.

(pp) Dr. HUNTER juſtly ſuppoſes that the rickets are owing to a want of the animal earth.

FINIS.

1. MK. 426 no. 1

COUNTWAY LIBRARY OF MEDICINE
QP
91
L57

RARE BOOKS DEPARTMENT